

SAIC MOTOR 上海汽车

Service Manual 2010

ROEWE 350

This manual provides information on the specifications, the system introduction, the service procedures and the adjustments for the 2010 CSA7150 series ROEWE 350 Vehicle.

The technicians, worked for the servicing station authorized by SAIC Motor, can provide better service for the owners of ROEWE 350 vehicle based on a profound understanding this manual and related updated Service Bulletins.

You are suggested that please contact SAIC Motor Passenger Vehicle Co., Ltd. if you want to obtain related information mentioned in this manual about the brand, the parts number, and special tools etc.

SAIC Motor Passenger Vehicle Co., Ltd.

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How To Use This Manual

General

To assist in the use of this Manual, it is divided into sections and sub-sections. The relevant sub-section title is given at the header of each page.

There is a single Contents section at the front of the Manual, which is divided by section and sub-section. The book is numbered from page 1. The page number is given at the bottom of each page.

The individual actions of the repair operations must be followed in the sequence in which they appear. Item numbers in the illustrations refer to the relevant numbered text under the illustration.

Adjustment and repair operations include reference to Service tool numbers and the associated illustration depicts the tool in use. Adjustment and repair operations also include reference to wear limits, relevant data, torque figures, and specialist information and useful assembly details. Each adjustment or repair operation is given a unique Repair Operation number.

WARNINGS, CAUTIONS, NOTES and TIPS have the following meanings:

When encountering a WARNING, you will be asked to take a necessary action or not to take a prohibited action. If a WARNING is not heeded, the following consequences may occur:

- Serious bodily injury or death to the technician.
- Serious bodily injury or death to other technicians in the workplace area.
- Serious bodily injury to the driver and/or passenger(s) of the vehicle, if the vehicle has been improperly repaired.

CAUTION call special attention to a necessary action or to a prohibited action. If a CAUTION is not heeded, the following consequences may occur:

- Damage to the vehicle.
- Unnecessary vehicle repairs.
- Unnecessary component replacement.
- Improper operation or performance of the system or component under repair.
- Damage to any systems or components which are dependent upon the proper operation of the system or component under repair.
- Improper operation or performance of any systems or components which are dependent upon the proper operation or performance of the system or component under repair.
- Damage to fasteners, basic tools, or special tools.
- The leakage of coolant, lubricant, or other vital fluids.

NOTE statements emphasize a necessary characteristic of a diagnostic or repair procedure. NOTE statements are designed to do the following:

- Clarify a procedure.
- Present additional information for accomplishing a procedure.
- Give insight into the reason or reasons for performing a procedure in the manner recommended.
- Present information that will help to accomplish a procedure in a more effective manner.
- Present information that gives the technician the benefit of past experience in accomplishing a procedure with greater ease.

TIP: Gives helpful information.

References

References to the LH or RH side given in this Manual are made when viewing the vehicle from the rear. With the engine and gearbox assembly removed, the crankshaft pulley end of the engine is referred to as the front.

Operations covered in this Manual do not include reference to testing the vehicle after repair. It is essential that work is inspected and tested after completion and if necessary a road test of the vehicle is carried out. This is of particular importance where safety related items are concerned.

Dimensions

The dimensions quoted are to design engineering specification. Service limits are included where applicable.

Our company are constantly seeking to improve the specification, design and production of their vehicles and alterations take place accordingly. While every effort has been made to ensure the accuracy of this Manual, it should not be regarded as an infallible guide to current specifications of any particular vehicle.

Repairs and Replacements

Parts

When replacement parts are required it is essential that only our company's recommended parts are used.

Attention is particularly drawn to the following points concerning repairs and the fitting of replacement parts and accessories.

- Safety features and corrosion prevention treatments embodied in the vehicle may be impaired if other than SMC recommended parts are fitted.
- Torque wrench setting figures given in this Manual must be used.
- Locking devices, where specified, must be fitted. If the efficiency of a locking device is impaired during removal it must be renewed.
- The terms of the vehicle warranty may be invalidated by the fitting of parts other than SMC recommended parts.

All SMC recommended parts have the full backing of the vehicle warranty.

SMC Dealers are obliged to supply only SMC recommended parts.

Special tools

Special tools have been developed to facilitate removal, dismantling and assembly of mechanical components in a cost effective and time efficient manner. The use of special tools also helps prevent the potential for damage to components.

Some operations in the manual cannot be carried out properly without the aid of the relevant special tools.

Special tools can be obtained from the following supplier.

Shanghai Xiangzhi Industrial Development Co., Ltd

Address: 17F, Building C, No.900, Yishan Road, Shanghai

Post Code: 200233

Tel: 021-54234810

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General Information

General Precautions

Dangerous Substances

Modern vehicles contain many materials and liquids which if not handled with care can be hazardous to both personal health and the environment.

Warning: *Many liquids and other substances used in vehicles are poisonous and should under no circumstances be consumed and should, as far as possible, be kept from contact with the skin. These liquids and substances include acid, anti-freeze, brake fluid, fuel, windscreen washer additives, lubricants, refrigerants and various adhesives.*

Warning: *Always read carefully the instructions printed on labels or stamped on components and obey them implicitly. Such instructions are included for reasons of your health and personal safety. Never disregard them.*

Synthetic Rubber

Many O-rings, seals, hoses, flexible pipes and other similar items which appear to be natural rubber, are in fact, made of synthetic materials called Fluoroelastomers. Under normal operating conditions this material is safe and does not present a health hazard. However, if the material is damaged by fire or excessive heating, it can break down and produce highly corrosive Hydrofluoric acid.

Contact with Hydrofluoric acid can cause serious burns on contact with skin. If skin contact does occur

- Remove any contaminated clothing immediately.
- Irrigate affected area of skin with a copious amount of cold water or limewater for 15 to 60 minutes.
- Obtain medical assistance immediately.

Should any material be in a burnt or overheated condition, handle with extreme caution and wear protective clothing (seamless industrial gloves, protective apron etc.).

Decontaminate and dispose of gloves immediately after use.

Lubricating Oils

Avoid excessive skin contact with used lubricating oils and always adhere to the health protection precautions.

Warning: *Avoid excessive skin contact with used engine oil. Used engine oil contains potentially harmful contaminants which may cause skin cancer or other serious skin disorders.*

Warning: *Avoid excessive skin contact with mineral oil. Mineral oils remove the natural fats from the skin, leading to dryness, irritation and dermatitis.*

Health Protection Precautions

The following precautions should be observed at all times.

- Wear protective clothing, including impervious gloves where practicable.
- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Do not put oily rags in pockets.
- Avoid contaminating clothes (particularly those next to the skin) with oil.
- Overalls must be cleaned regularly. Discard heavily soiled clothing and oil impregnated footwear.
- First aid treatment should be obtained immediately for open cuts and wounds.
- Apply barrier creams before each work period to help prevent lubricating oil from contaminating the skin.
- Wash with soap and water to ensure all oil is removed (proprietary skin cleansers and nail brushes will help).
- Use moisturisers after cleaning; preparations containing lanolin help replace the skin's natural oils which have been removed.
- Do not use petrol/gasoline, kerosene, diesel fuel, oil, thinners or solvents for cleaning skin.
- Where practicable, degrease components prior to handling.
- If skin disorders develop, obtain medical advice without delay.
- Wear eye protection (e.g. goggles or face shield) if there is a risk of eye contamination. Eye wash facilities should be provided in close vicinity to the work area.

General Information

Safety Instructions

Jacking

Caution: N/A

Always use the recommended jacking points.

Always ensure that any lifting apparatus has sufficient load capacity for the weight to be lifted.

Ensure the vehicle is standing on level ground prior to lifting or jacking.

Apply the parking brake and chock the wheels.

Warning: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Do not leave tools, lifting equipment, spilt oil, etc. around or on the work bench area. Always keep a clean and tidy work area.

Brake Shoes and Pads

Always fit the correct grade and specification of brake linings. When renewing brake pads and brake shoes, always replace as complete axle sets.

Brake Hydraulics

Observe the following recommendations when working on the brake system:

- Ensure that hoses run in a natural curve and are not kinked or twisted.
- Ensure that hoses run in a natural curve and are not kinked or twisted.
- Fit brake pipes securely in their retaining clips and ensure that the pipe cannot contact a potential chafing point.
- Containers used for brake fluid must be kept absolutely clean.
- Do not store brake fluid in an unsealed container, it will absorb water and in this condition would be dangerous to use due to a lowering of its boiling point.
- Do not allow brake fluid to be contaminated with mineral oil, or put new brake fluid in a container which has previously contained mineral oil.
- Do not re-use brake fluid removed from the system.
- Always use clean brake fluid or a recommended alternative to clean hydraulic components.
- After disconnection of brake pipes and hoses, immediately fit suitable blanking caps or plugs to prevent the ingress of dirt.
- Only use the correct brake fittings with compatible threads.
- Observe absolute cleanliness when working with hydraulic components.

Cooling System Caps and Plugs

expansion tank caps and coolant drain or bleed screws when the engine is hot, especially if it is overheated. To avoid the possibility of scalding, allow the engine to cool before attempting removal.

Environmental Precautions

General

This section provides general information which can help to reduce the environmental impacts from the activities carried out in workshops.

Emissions to Air

Many of the activities that are carried out in workshops emit gases and fumes which contribute to global warming, depletion of the ozone layer and/or the formation of photochemical smog at ground level. By considering how the workshop activities are carried out, these gases and fumes can be minimised, thus reducing the impact on the environment.

Exhaust fumes

Running car engines is an essential part of workshop activities and exhaust fumes need to be ventilated to atmosphere. However, the amount of time engines are running and the position of the vehicle should be carefully considered at all times, to reduce the release of poisonous gases and minimise the inconvenience to people living nearby.

Solvents

Some of the cleaning agents used are solvent based and will evaporate to atmosphere if used carelessly, or if cans are left unsealed. All solvent containers should be firmly closed when not needed and solvent should be used sparingly. Suitable alternative materials may be available to replace some of the commonly used solvents. Similarly, many paints are solvent based and the spray should be minimised to reduce solvent emissions.

Refrigerant

Discharge and replacement of these materials from air conditioning units should only be carried out using the correct equipment.

Engines:

Always adhere to the following.

- Don't leave engines running unnecessarily;
- Minimise testing times and check where the exhaust fumes are being blown.

Materials:

- Keep lids on containers of solvents;
- Only use the minimum quantity;
- Consider alternative materials;
- Minimise over-spray when painting.

Gases:

- Use the correct equipment for collecting refrigerants;
- Don't burn rubbish on site.

Discharges to Water

Oil, petrol, solvent, acids, hydraulic oil, antifreeze and other such substances should never be poured down the drain and every precaution must be taken to prevent spillage reaching the drains.

Handling of such materials must take place well away from the drains and preferably in an area with a kerb or wall around it, to prevent discharge into the drain. If a spillage occurs it should be soaked up immediately. Having a spill kit available will make this easier.

Checklist

Always adhere to the following disposal and spillage prevention instructions.

- Never pour anything down a drain without first checking that it is environmentally safe to do so, and that it does not contravene any local regulations.
- Store liquids in a walled area;
- Protect bulk storage tanks from vandalism by locking the valves;
- Transfer liquids from one container to another in an area away from open drains;
- Ensure lids are replaced securely on containers;
- Make sure that taps on liquid containers are secure and cannot be accidentally turned on;
- Have spill kits available near to points of storage and handling of liquids.

Spill kits

Special materials are available to absorb a number of different substances. They can be in granular form, ready to use and bought in convenient containers for storage. Disposal of used spill-absorbing material is dealt with in 'Waste Management' section.

Land Contamination

Oils, fuels and solvents etc. can contaminate any soil that they are allowed to contact. Such materials should never be disposed of by pouring onto soil and every precaution must be taken to prevent spillage reaching soil. Waste materials stored on open ground could also leak, or have polluting substances washed off them that would contaminate the land. Always store these materials in suitable robust containers.

Checklist

Always adhere to the following.

- Don't pour or spill anything onto the soil or bare ground;
- Don't store waste materials on bare ground, see 'Spillage prevention' list.

General Information

Local Issues

A number of environmental issues will be of particular concern to residents and other neighbours close to the site. The sensitivity of these issues will depend on the proximity of the site and the layout and amount of activity carried on at the site.

Car alarm testing, panel beating, hammering and other such noisy activities should, whenever possible, be carried out indoors with doors and windows shut or as far away from houses as possible.

Be sensitive to the time of day when these activities are carried out and minimise the time of the noisy operation, particularly in the early morning and late evening.

Another local concern will be the smell from the various materials used. Using less solvent, paint and petrol could help prevent this annoyance.

Local residents and other business users will also be concerned about traffic congestion, noise and exhaust fumes, be sensitive to these concerns and try to minimise inconvenience from deliveries, customers and servicing operations.

Checklist

Always adhere to the following.

- Identify where the neighbours who are likely to be affected are situated;
- Minimise noise, smells and traffic nuisance;
- Prevent litter by disposing of waste in the correct manner;
- Have waste containers emptied regularly.

Waste Management

One of the major ways that pollution can be reduced is by the careful handling, storage and disposal of all waste materials that occur on sites. This means that it is necessary to not only know what the waste materials are, but also to have the necessary documentation and to know local regulations that apply.

Handling and storage of waste

They should be stored in such a way as to prevent the escape of the material to land, water or air.

They must also be segregated into different types of waste e.g. oil, metals, batteries, used vehicle components. This will prevent any reaction between different materials and assist in disposal.

Disposal of waste

Disposal of waste materials must only be to waste carriers who are authorised to carry those particular waste materials and have all the necessary documentation. The waste carrier is responsible for ensuring that the waste is taken to the correct disposal sites.

Dispose of waste in accordance with the following guidelines.

- Fuel, hydraulic fluid, anti-freeze and oil: keep separate and dispose of to specialist contractor.
- Refrigerant: collect in specialist equipment and reuse.
- Detergents: safe to pour down the foul drain if diluted.
- Paint, thinners: keep separate and dispose of to specialist contractor.
- Components: send back to supplier for refurbishment, or disassemble and reuse any suitable parts. Dispose of the remainder in ordinary waste.
- Small parts: reuse any suitable parts, dispose of the remainder in ordinary waste.
- Metals: can be sold if kept separate from general waste.
- Tyres: keep separate and dispose of to specialist contractor.
- Packaging: compact as much as possible and dispose of in ordinary waste.
- asbestos material keep separate and dispose of to specialist contractor.
- Oily and fuel wastes (e.g. rags, used spill kit material): keep separate and dispose of to specialist contractor.
- Air filters: keep separate and dispose of to specialist contractor.
- Rubber/plastics: dispose of in ordinary waste.
- Hoses: dispose of in ordinary waste.
- Batteries: keep separate and dispose of to specialist contractor.
- Airbags - explosives: keep separate and dispose of to specialist contractor.
- Electrical components: send back to supplier for refurbishment, or disassemble and reuse any suitable parts. Dispose of the remainder in ordinary waste.
- Catalysts: can be sold if kept separate from general waste
- Used spill-absorbing material: keep separate and dispose of to specialist contractor.

General Fitting Instructions

Component Removal

Whenever possible, clean components and surrounding area before removal.

- Blank off openings exposed by component removal.
- Immediately seal fuel, oil or hydraulic lines when apertures are exposed; use plastic caps or plugs to prevent loss of fluid and ingress of dirt.
- Close the open ends of oilways exposed by component removal with tapered hardwood plugs or conspicuous plastic plugs.
- Immediately a component is removed, place it in a suitable container; use a separate container for each component and its associated parts.
- Clean bench and provide marking materials, labels and containers before dismantling a component.

Dismantling

Observe scrupulous cleanliness when dismantling components, particularly when brake, fuel or hydraulic system parts are being worked on. A particle of dirt or a cloth fragment could cause a serious malfunction if trapped in these systems.

- Blow out all tapped holes, crevices, oilways and fluid passages with an air line. Ensure that any O-rings used for sealing are correctly replaced or renewed, if disturbed during the process.
- Use marking ink to identify mating parts and ensure correct reassembly. Do not use a centre punch or scriber to mark parts, they could initiate cracks or distortion in marked components.
- Wire together mating parts where necessary to prevent accidental interchange (e.g. roller bearing components).
- Attach labels to all parts which are to be renewed, and to parts requiring further inspection before being passed for reassembly; place these parts in separate containers from those containing parts for rebuild.
- Do not discard a part due for renewal until after comparing it with a new part, to ensure that its correct replacement has been obtained.

Cleaning Components

Always use the recommended cleaning agent or equivalent. Ensure that adequate ventilation is provided when volatile degreasing agents are being used. Do not use degreasing equipment for components containing items which could be damaged by the use of this process.

General Inspection

All components should be inspected for wear or damage before being reassembled.

- Never inspect a component for wear or dimensional check unless it is absolutely clean; a slight smear of grease can conceal an incipient failure.
- When a component is to be checked dimensionally against recommended values, use the appropriate measuring equipment (surface plates, micrometers, dial gauges etc.). Ensure the measuring equipment is calibrated and in good serviceable condition.
- Reject a component if its dimensions are outside the specified tolerances, or if it appears to be damaged.
- A part may be refitted if its critical dimension is exactly to its tolerance limit and it appears to be in satisfactory condition. Use 'Plastigauge' for checking bearing surface clearances.

General Information

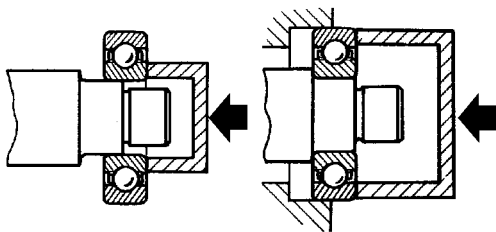
Ball and Roller Bearings

General

When removing and installing bearings, ensure that the following practices are observed to ensure component serviceability.

- Remove all traces of lubricant from bearing under inspection by cleaning with a suitable degreasant; maintain absolute cleanliness throughout operations.
- Hold inner race of bearing between finger and thumb of one hand and spin outer race to check that it revolves absolutely smoothly. Repeat, holding outer race and spinning inner race.
- Rotate outer ring gently with a reciprocating motion, while holding inner ring; feel for any check or obstruction to rotation. Reject bearing if action is not perfectly smooth.
- Lubricate bearing with generous amounts of lubricant appropriate to installation.
- Inspect shaft and bearing housing for discoloration or other markings which indicate movement between bearing and housing.
- Ensure that shaft and housing are clean and free from burrs before fitting bearing.
- If one bearing of a pair shows an imperfection, it is advisable to replace both with new bearings; an exception could be if the faulty bearing had covered a low mileage, and it can be established that damage is confined to only one bearing.
- Never refit a ball or roller bearing without first ensuring that it is in a fully serviceable condition.
- When hub bearings are removed or displaced, new bearings must be fitted; do not attempt to refit the old hub bearings.
- When fitting a bearing to a shaft, only apply force to the inner ring of the bearing. When fitting a bearing into a housing, only apply force to the outer ring of the bearing.

- In the case of grease lubricated bearings (e.g. hub bearings) fill the space between bearing and outer seal with the recommended grade of grease before fitting seal.
- Always mark components of separable bearings (e.g. taper roller bearings) when dismantling, to ensure correct reassembly. Never fit new rollers in a used outer ring; always fit a complete new bearing assembly.



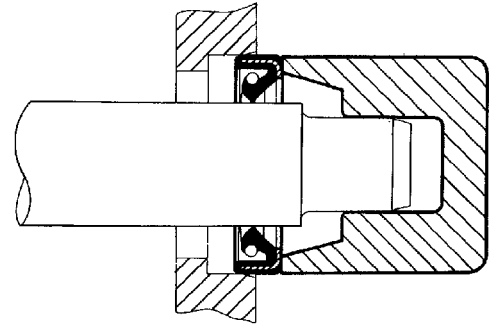
S003040

Oil Seals

General

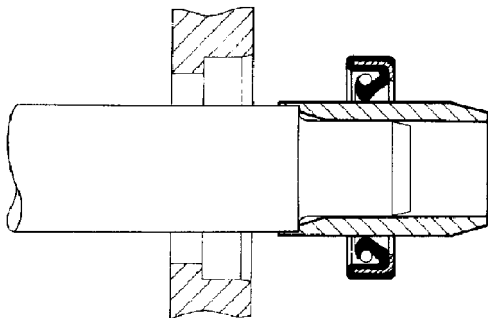
Always renew oil seals which have been removed from their working location (whether as an individual component or as part of an assembly). NEVER use a seal which has been improperly stored or handled, such as hung on a hook or nail.

- Carefully examine seal before fitting to ensure that it is clean and undamaged.
- Ensure the surface on which the new seal is to run is free of burrs or scratches. Renew the component if the original sealing surface cannot be completely restored.
- Protect the seal from any surface which it has to pass when being fitted. Use a protective sleeve or tape to cover the relevant surface.
- Lubricate the sealing lips with a recommended lubricant before use to prevent damage during initial use. On dual lipped seals, smear the area between the lips with grease.
- If a seal spring is provided, ensure that it is fitted correctly. Place lip of seal towards fluid to be sealed and slide into position on shaft. Use fitting sleeve where possible to protect sealing lip from damage by sharp corners, threads or splines. If a fitting sleeve is not available, use plastic tube or tape to prevent damage to the sealing lip.



S003042

- Use the recommended service tool to fit an oil seal. If the correct service tool is not available, use a suitable tube approximately 0.4 mm (0.015 in.) smaller than the outside diameter of the seal. Use a hammer VERY GENTLY on drift if a suitable press is not available.
- Use the recommended service tool to fit an oil seal. If the correct service tool is not available, use a suitable tube approximately 0.4 mm (0.015 in.) smaller than the outside diameter of the seal. Use a hammer VERY GENTLY on drift if a suitable press is not available.



S003041

- Grease outside diameter of seal, place square to housing recess and press into position using great care, and if possible a 'bell piece' to ensure that seal is not tilted. In some cases it may be preferable to fit seal to housing before fitting to shaft. Never let weight of unsupported shaft rest in seal.

General Information

Joints and Joint Faces

General

Fit joints dry unless specified otherwise.

- Always use the correct gaskets as specified.
- When sealing compound is used, apply in a thin uniform film to metal surfaces; take care to prevent sealing compound from entering oilways, pipes or blind tapped holes.
- If gaskets and/or sealing compound is recommended for use; remove all traces of old sealing compound prior to reassembly. Do not use a tool which will damage the joint faces and smooth out any scratches or burrs using an oil stone.
- Prior to reassembly, blow through any pipes, channels or crevices with compressed air.

Locking Devices

General

Always replace locking devices with one of the same design.

Tab Washers

Always release locking tabs and fit new locking washers. Do not re-use locking tabs.

Locking Nuts

Always use a backing spanner when loosening or tightening locking nuts, brake and fuel pipe unions.

Roll Pins

Always fit new roll pins of an interference fit in the hole.

Circlips

Always fit new circlips of the correct size for the groove.

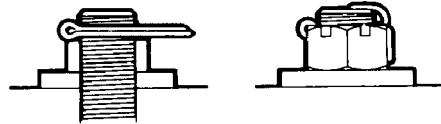
Keys and Keyways

Remove burrs from edges of keyways with a fine file and clean thoroughly before attempting to refit key.

Clean and inspect key closely; keys are suitable for refitting only if indistinguishable from new, as any indentation may indicate the onset of wear.

Split Pins

Always fit new split-pins of the correct size for the hole in the bolt or stud.



S003043

Screw Threads

General

Metric threads to ISO standards are used.

Damaged nuts, bolts and screws must always be discarded. Cleaning damaged threads with a die or tap impairs the strength and fit of the threads and is not recommended.

Always ensure that replacement bolts are at least equal in strength to those replaced.

Castellated nuts must not be loosened to accept a split-pin, except in recommended cases when this forms part of an adjustment.

Do not allow oil or grease to enter blind threaded holes. The hydraulic action on screwing in the bolt or stud could split the housing.

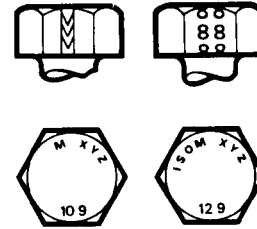
Always tighten a nut or bolt to the recommended torque figure. Damaged or corroded threads can affect the torque reading.

To check or re-tighten a bolt or screw to a specified torque figure, first loosen a quarter of a turn, then re-tighten to the correct torque figure.

Oil thread lightly before tightening to ensure a free running thread, except in the case of threads treated with sealant/lubricant, and selflocking nuts.

Fasteners Identification

Bolt Identification

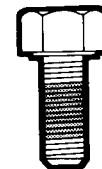


S003044

An ISO metric bolt or screw made of steel and larger than 6 mm in diameter can be identified by either of the symbols ISO M or M embossed or indented on top of the bolt head.

In addition to marks identifying the manufacturer, the top of the bolt head is also marked with symbols indicating the strength grade, e.g. 8.8; 10.9; 12.9; 14.9. As an alternative, some bolts and screws have the M and strength grade symbol stamped on the flats of the hexagon.

Encapsulated Bolts and Screws



S003045

Encapsulated bolts and screws have a microencapsulated locking agent pre-applied to the thread. They are identified by a coloured section which extends 360° around the thread. The locking agent is released and activated by the assembly process and is then chemically cured to provide the locking action.

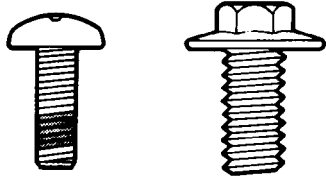
Unless a specific repair procedure states otherwise, encapsulated bolts may be reused providing the threads are undamaged and the following procedure is adopted:

- Remove loose adhesive from the bolt and housing threads.
- Ensure threads are clean and free of oil and grease.
- Apply an approved locking agent.

General Information

An encapsulated bolt may be replaced with a bolt of equivalent specification provided it is treated with an approved locking agent.

Self-locking Bolts and Screws



S003046

Self-locking bolts and screws, i.e. nylon patched or trilobular thread can be reused providing resistance can be felt when the locking portion enters the female thread.

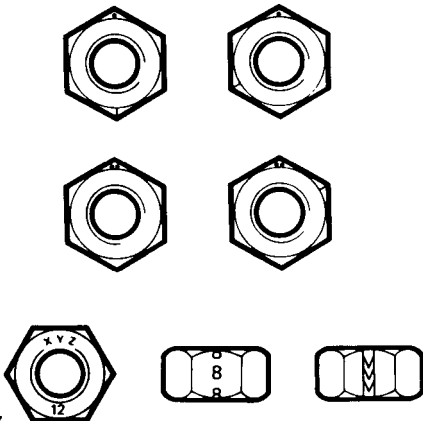
Nylon patched bolts and screws have a locking agent pre-applied to the threads. They are identified by the presence of a coloured section of thread which extends for up to 180° around the thread.

Trilobular bolts (i.e. Powerlok) have a special thread form which creates a slight interference with the thread of the hole or nut into which it is screwed.

DO NOT reuse self-locking fasteners in critical locations (e.g. engine bearings, flywheel). Always use the correct replacement self-locking nut, bolt or screw.

DO NOT fit non self-locking fasteners in applications where a self-locking nut, bolt or screw is specified.

Nut Identification A



S003047

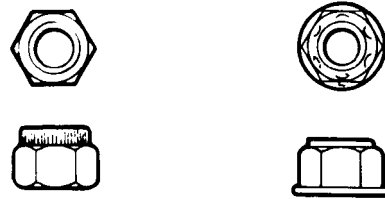
A nut with an ISO metric thread is marked on one face or on one of the flats of the hexagon with the strength grade symbol 8, 12, or 14. Some nuts with a strength grade 4, 5 or 6 are

also marked and some have the metric symbol M on the flat opposite the strength grade marking.

When tightening a slotted or castellated nut, never loosen it to insert a split pin except where recommended as part of an adjustment. If difficulty is experienced, alternative washers or nuts should be selected, or the washer thickness reduced.

Where bearing preload is involved, nuts should be tightened in accordance with special instructions.

Self-locking nuts



S003048

Self-locking nuts, e.g. nylon insert or deferred thread nuts, can be reused providing resistance can be felt when the locking portion of the nut passes over the thread of the bolt or stud.

Where self-locking nuts have been removed, it is advisable to replace them with new ones of the same type.

Don't use non self-lock nuts in the area where self-lock nuts must be used.

Flexible Pipes and Hoses

General

When removing and installing flexible hydraulic pipes and hoses, ensure that the following practices are observed to ensure component serviceability.

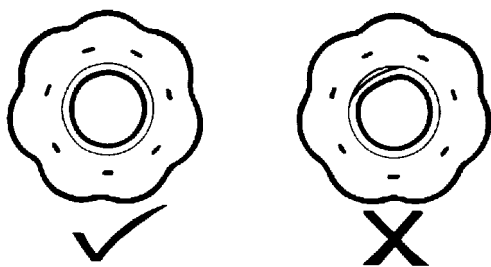
- Clean end fittings and the area surrounding them as thoroughly as possible.
- Obtain appropriate plugs or caps before detaching hose end fittings, so that the ports can be immediately covered to prevent the ingress of dirt.

Clean hose externally and blow through with airline. Examine carefully for cracks, separation of plies, security of end fittings and external damage. Reject any faulty hoses.

- When refitting a hose, ensure that no unnecessary bends are introduced, and that hose is not twisted before or during tightening of union nuts.
- Fit a cap to seal a hydraulic union and a plug to its socket after removal to prevent ingress of dirt.
- Absolute cleanliness must be observed with hydraulic components at all times.

After any work on hydraulic systems, carefully inspect for leaks underneath the vehicle while a second operator applies maximum brake pressure to the brakes (engine running) and operates the steering.

Fuel System Hoses



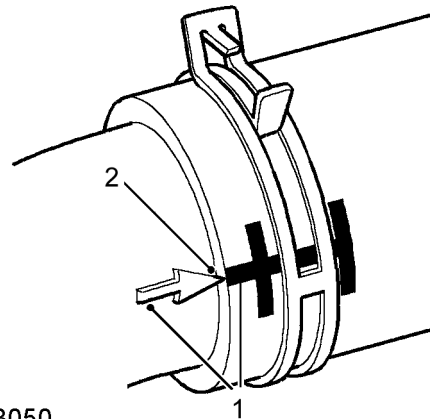
S003049

All fuel hoses are made up of two laminations, an armoured rubber outer sleeve and an inner viton core. If any of the fuel system hoses have been disconnected, it is imperative that the internal bore is inspected to ensure that the viton lining has not become separated from the armoured outer sleeve. A new hose must be fitted if separation is evident.

Cooling System Hoses

The following precautions MUST be followed to ensure that integrity of cooling hoses and their connections to system components are maintained.

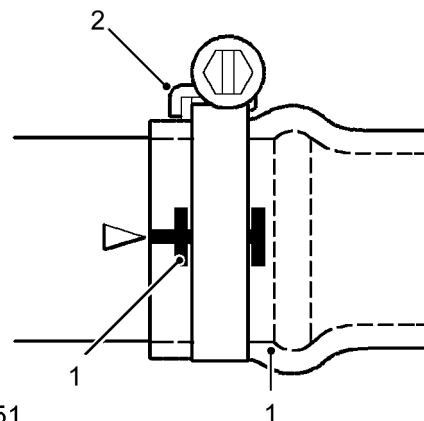
Hose orientation and connection



S003050

Correct orientation of cooling hoses is important in ensuring that the hose does not become fatigued or damaged through contact with adjacent components. Where 'timing' marks (1) are provided on the hose and corresponding connection, these must be used to ensure correct orientation. Hoses must be pushed fully onto their connection points. Usually, a moulded form (2) on the stub pipe provides a positive indicator.

hose clip



S003051

Markings (1) are usually provided on the hose to indicate the correct clip position. If no markings are provided, position the clip directly behind the retaining lip at the end of the stub as shown. Worm drive clips should be oriented with the crimped side of the drive housing (2) facing towards the end of the hose, or the hose may become pinched between the clip and the stub pipe retaining lip. Worm drive clips should be tightened to 3 Nm unless otherwise stated. Ensure that hose clips do not foul adjacent components.

Heat protection

Always ensure that heatshields and protective sheathing are in good condition. Replace if damage is evident. Particular care must be taken when routing hoses close to hot engine components, such as the exhaust manifold and the Exhaust Gas Recirculation (EGR) pipe. Hoses will relax and deflect slightly

General Information

when hot; ensure this movement is taken into account when routing and securing hoses.

Fuel Handling Precautions

General

Fuel vapour is highly flammable and in confined spaces is also explosive and toxic. The vapour is heavier than air and will always fall to the lowest level. The vapour can be easily distributed throughout a workshop by air currents; consequently, even a small spillage of fuel is potentially very dangerous.

The following information provides basic precautions which must be observed if fuel is to be handled safely. It also outlines other areas of risk which must not be ignored. This information is issued for basic guidance only, if in doubt consult your local Fire Officer.

Always have a fire extinguisher containing FOAM, CO₂, GAS or POWDER close at hand when handling or draining fuel or when dismantling fuel systems. Fire extinguishers should also be located in areas where fuel containers are stored.

Always disconnect the vehicle battery before carrying out dismantling or draining work on a fuel system.

Whenever fuel is being handled, drained or stored, or when fuel systems are being dismantled, all forms of ignition must be extinguished or removed; any lead lamps must be flameproof and kept clear of spillage.

Warning: No one should be permitted to repair components associated with fuel without first having specialist training.

Warning: Do not remove fuel system components while the vehicle is over a pit.

Fuel Tank Draining

Fuel tank draining should be carried out in accordance with the procedure outlined in the FUEL DELIVERY section of this manual and observing the following precautions

Warning: Do not remove fuel system components while the vehicle is over a pit. Extraction or draining of fuel must be carried out in a well ventilated area.

The capacity of containers must be more than adequate for the amount of fuel to be extracted or drained. The container should be clearly marked with its contents and placed in a safe storage area which meets the requirements of local authority regulations.

Fuel Tank Removal

When the fuel line is secured to the fuel tank outlet by a spring steel clip, the clip must be released before the fuel line is disconnected or the fuel tank is removed. This procedure will avoid the possibility of fumes in the fuel tank being ignited when the clip is released.

As an added precaution, fuel tanks should have a 'FUEL VAPOUR' warning label attached to them as soon as they are removed from the vehicle.

Fuel Tank Repairs

No attempt should be made to repair a plastic fuel tank. If the structure of the tank is damaged, a new tank must be fitted.

Body Repairs

Plastic fuel pipes are particularly susceptible to heat, even at relatively low temperature, and can be melted by heat conducted from some distance away.

When body repairs involve the use of heat, all fuel pipes which run in the vicinity of the repair area must be removed, and the tank outlet plugged.

Warning: *If welding is to be carried out in the vicinity of the fuel tank, the fuel system must be drained and the tank removed before welding commences.*

Electrical Precautions

General

The following guidelines are intended to ensure the safety of the operator while preventing damage to the electrical and electronic components fitted to the vehicle. Where necessary, specific precautions are detailed in the individual procedures of this manual.

Equipment

Prior to commencing any test procedure on the vehicle ensure that the relevant test equipment is working correctly and any harness or connectors are in good condition. It is particularly important to check the condition of the lead and plugs of mains operated equipment.

Polarity

Never reverse connect the vehicle battery and always ensure the correct polarity when connecting test equipment.

High Voltage Circuits

Whenever disconnecting live HT circuits always use insulated pliers and never allow the open end of the HT lead to contact other components, particularly ECUs. Exercise caution when measuring the voltage on the coil terminals while the engine is running, high voltage spikes can occur on these terminals.

Connectors and Harnesses

The engine compartment of a vehicle is a particularly hostile environment for electrical components and connectors:

- Always ensure electrically related items are dry and oil free before disconnecting and connecting test equipment.
- Ensure disconnected multiplugs and sensors are protected from being contaminated with oil, coolant or other solutions. Contamination could impair performance or result in catastrophic failure.
- Never force connectors apart using tools to prise apart or by pulling on the wiring harness.
- Always ensure locking tabs are disengaged before disconnection, and match orientation to enable correct reconnection.
- Ensure that any protection (covers, insulation etc.) is replaced if disturbed.

Having confirmed a component to be faulty:

- Switch off the ignition and disconnect the battery.
- Remove the component and support the disconnected harness.
- When replacing the component keep oily hands away from electrical connection areas and push connectors home until any locking tabs fully engage.

General Information

Battery Disconnection

Before disconnecting the battery, disable the alarm system and switch off all electrical equipment.

Caution: *To prevent damage to electrical components, always disconnect the battery when working on the vehicle's electrical system. The ground lead must be disconnected first and reconnected last.*

Caution: *Always ensure that battery leads are routed correctly and are not close to any potential chafing points.*

Battery Charging

Always ensure any battery charging area is well ventilated and that every precaution is taken to avoid naked flames and sparks.

Disciplines

Remove the handset prior to making any connection or disconnection in the system to prevent electrical surges caused by disconnecting 'live' connections damaging electronic components.

Ensure hands and work surfaces are clean and free of grease, swarf, etc. Grease collects dirt which can cause electrical tracking (shortcircuits) or high resistance contacts.

When handling printed circuit boards, treat with care and hold by the edges only; note that some electronic components are susceptible to body static.

Connectors should never be subjected to forced removal or refit, especially inter-board connectors. Damaged contacts can cause short-circuit and open-circuit fault conditions.

Prior to commencing test, and periodically during a test, touch a good vehicle body earth to discharge static charge. Some electronic components are vulnerable to the static electricity that may be generated by the operator.

Electrical Multiplugs Lubricate

In order to prevent corrosion, Some multiplugs under bonnet and carpet is wiped special lubricate in factory. If these is destroyed in maintaining, repair and replacing process, special lubricate should be newly wiped

Supplementary Restraint System Precautions

General Precautions

The SRS system contains components which could be potentially hazardous to the service engineer if not serviced and handled correctly. The following guidelines are intended to alert the service engineer to potential sources of danger and emphasise the importance of ensuring the integrity of SRS components fitted to the vehicle.

Warning: *Always follow the 'SRS Precautions' and the correct procedures for working on SRS components. Persons working on SRS systems must be fully trained and have been issued with copies of the Safety guidelines.*

Warning: *It is imperative that before any work is undertaken on the SRS system the appropriate information is read thoroughly.*

Warning: *The airbag module contains sodium azide which is poisonous and extremely flammable. Contact with water, acid or heavy metals may produce harmful or explosive compounds. Do not dismantle, incinerate or bring into contact with electricity, before the unit has been deployed.*

Warning: *Always replace a seat belt assembly that has withstood the strain of a severe vehicle impact, or if the webbing shows signs of fraying.*

Warning: *Always disconnect the vehicle battery before carrying out any electric welding on a vehicle fitted with an SRS system.*

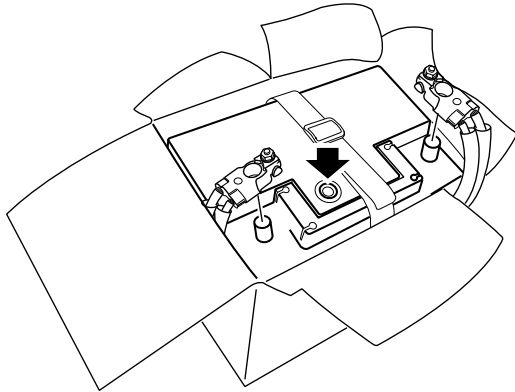
Caution: *Do not expose an airbag module or seat belt pre-tensioner to heat exceeding 85° C.*

It should be noted that these precautions are not restricted to operations performed when servicing the SRS system, the same care must be exercised when working on ancillary systems and components located in the vicinity of the SRS components; these include, but are not limited to:

- Steering system steering wheel airbag, rotary coupler.
- Front fascia passenger front airbag.
- Interior trim ICS Head Curtain Airbags ('A'-post trim, 'B'-post upper trim, grab handles, headlining above front doors ;SRS Electronic Control Unit (ECU) (beneath centre console); side impact crash sensors (under carpet beneath front seats)
- Seats side (thorax) airbags.
- Electrical system—SRS harnesses, link leads and connectors.

Making the system safe

Before working on, or in the vicinity of **SRS** components, ensure the system is rendered safe by performing the following procedures:



S003092

- Remove the handset from the docking station.
- Disconnect both battery leads, earth lead first.
- Wait 10 minutes for **SRSECU** the SRS ECU back-up power circuit to discharge.

The **SRS** system uses energy reserve capacitors to keep the system active in the event of electrical supply failure under crash conditions. It is necessary to allow the capacitor sufficient time to discharge (10 minutes) in order to avoid the risk of accidental deployment.

Caution: N/A

Installation

In order to ensure system integrity, it is essential that the SRS system is regularly checked and maintained **SRS** so that it is ready for effective operation in the event of a collision. Carefully inspect SRS components before installation. **SRS** Do not install a part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.

Warning: The integrity of the SRS system is critical for safety reasons.

Ensure the following precautions are always adhered to:

- Never install used SRS components from another vehicle **SRS** or attempt to repair an **SRS** component.
- Never use the SRS parts without a clear identification **SRS** label.
- Never use an airbag or **SRS** ECU that has been dropped.
- When repairing an SRS system only use **SRS** genuine new parts.
- Never apply electrical power to an SRS component unless instructed to do **SRS** so as part of an approved test procedure.

- Ensure the bolts are tightened to the correct torque. Always use new fixings **SRS** when replacing SRS components.
- Ensure the ECU is always installed correctly. **SRS ECU SRSECU** There must not be any gap between the ECU and the bracket to which it is mounted. **SRSECU** An incorrectly mounted ECU could cause the system to malfunction.
- Do not supply power to the ECU are connected. **SRS** before all SRS components **SRSECU** before all SRS components.

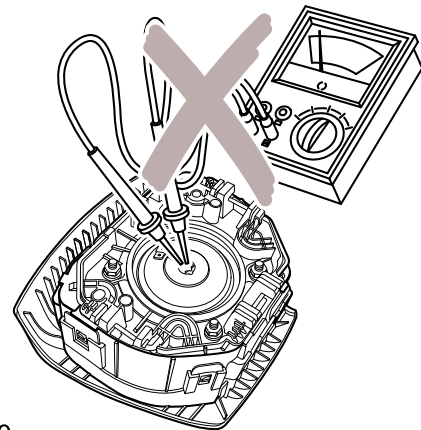
Caution: Ensure SRS components are not contaminated with oil, grease, detergent or water.

Caution: Torque wrenches should be regularly checked for accuracy to ensure that all fixings are tightened to the correct torque.

Caution: Following seat belt pretensioner deployment, the seat belts can still be used as conventional seat belts, but will need to be replaced as soon as possible to re-establish full SRS protection.

Caution: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

SRS component testing precautions



S003080

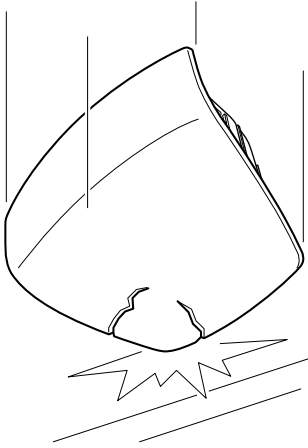
The **SRS** components are triggered using relatively low operating currents, always adhere to the following precautions:

Warning: Do not use a multimeter or other general purpose test equipment on SRS system components or accidental deployment may occur. Only use the recommended diagnostic equipment to diagnose system faults.

Warning: Do not use electrical test equipment on the SRS harness while it is connected to any of the SRS system components. It may cause accidental deployment and personal injury.

General Information

Handling and storage



S003081

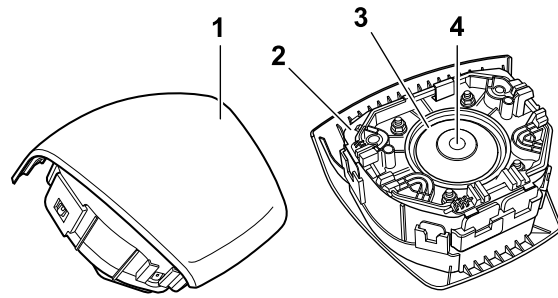
Always comply with the following handling precautions.

Warning: The SRS components are sensitive and potentially hazardous if not handled correctly; always comply with the following handling precautions:

- ECU and airbag must be stored in a cabinet in a dry room at normal room temperatures not exceeding 85° C. Ensure that heating, fire, water and other chemical corrosive substances cannot contaminate the stored SRS components.
- For safety reasons, do not store inflammable goods close to the area where the SRS components are stored.
- Keep new airbag module in the original packaging, until just before fitting.
- The storage area must comply with all legal requirements. It must have suitable fire extinguishers or other fire extinguishing equipment.
- Never drop an SRS component. The airbag diagnostic control unit is a particularly shock sensitive device and must be handled with extreme care.
- Never wrap your arms around an airbag module. If an airbag module has to be carried, hold it by the cover, with the cover uppermost and the base away from your body.
- Never transport airbag modules or seat belt pre-tensioners in the cabin of a vehicle.

Warning: Never attach anything to an airbag cover or any trim component covering an airbag module. Do not allow anything to rest on top of an airbag module.

Caution: Do not apply grease or cleaning solvents to seat belt pretensioner units, component failure could result.



S003082

Warning: Store the airbag module with the deployment side uppermost. If it is stored deployment side down, accidental deployment will propel the airbag module with enough force to cause serious injury.

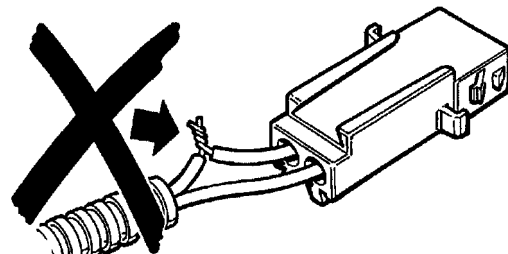
Warning: Airbag modules and seat belt pre-tensioners are classed as explosive devices. For overnight and longer term storage, they must be stored in a secure steel cabinet which has been approved as suitable for the purpose and has been registered by the local authority.

Warning: N/A

Warning: Store the airbag module or seat belt pre-tensioners in a designated storage area.

Caution: Improper handling or storage can internally damage the airbag module, making it inoperative. If you suspect the airbag module has been damaged, install a new module and refer to the Deployment/Disposal Procedures for disposal of the damaged module.

SRS Harnesses and Connectors



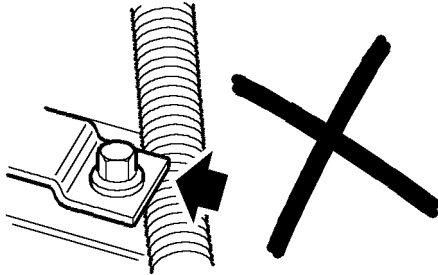
S003005

Always observe the following precautions **SRS** with regards to SRS system electrical wiring:

- Never attempt to modify, splice or repair **SRS** wiring.
- Never install electronic equipment (such as a mobile telephone, two-way radio or in-car entertainment

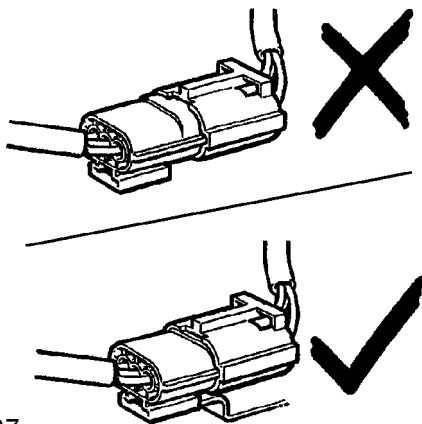
system) in such a way that it could generate electrical interference in the airbag harness. Seek specialist advice when installing such equipment.

Note: *SRS system wiring can be identified by a special yellow outer sleeve protecting the wires (black with yellow stripe protective coverings are sometimes used).*



S003006

Warning: *Always ensure SRS wiring is routed correctly. Be careful to avoid trapping or pinching the SRS wiring. Do not leave the connectors hanging loose or allow SRS components to hang from their harnesses. Look for possible points of chafing.*



S003007

Precautions for vehicle owners

For the airbag to work effectively and protect vehicle owners, follow the precautions listed below.

Driver and passengers must use seat belts correctly. Correctly using the seat belts can protect the body and reduce injuries in the event of an accident.

Never fit any accessory that obstructs or impairs the operation of the seat belt pretensioners or airbags.

Do not place any object on the steering wheel or instrument panel that could penetrate an inflating airbag or be a thrown item likely to cause injury.

Never fit cover on seat which fitting side airbag.

Children under 12 years old should not sit in the front seat.

Only genuine accessory parts are allowed to be installed.

Only authorised people can remove airbag modules, ECU, SRS system wiring harness and connectors. **SRSECU** and **SRS** system wiring harness and connectors.

If the airbag and seat belt pre-tensioner are deployed during an accident, **SRSECU** must be replaced and discarded.

Every SRS system on every car **SRS** has been paired and identified, **SRS** illegally adding or modifying the SRS system and the wiring harness could injure people.

Modifying the vehicle structure or SRS system is strictly not allowed **SRS** and may cause wrong airbag deployment or failure to deploy when required.

ROTARY COUPLER PRECAUTIONS

Caution: *Always follow the procedure for fitting and checking the rotary coupler as instructed in the SRS repairs section. Comply with all safety and installation procedures to ensure the system functions correctly.*

Observe the following precautions:

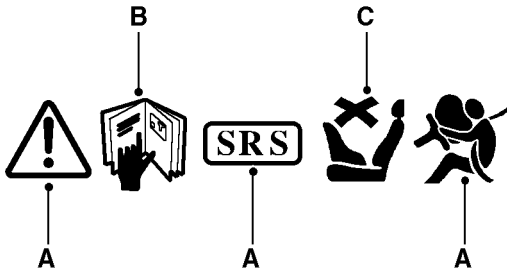
- Do not unlock and rotate the rotary coupler when it is removed from the vehicle.
- Do not turn the road wheels when the rotary coupler is removed from the vehicle.
- Always ensure the rotary coupler is removed and installed in its centred position and with the front road wheels in the straight ahead position - procedure. **SRS** refer to the SRS repair section for the correct removal and installation
- If a new rotary coupler is being installed, ensure the locking tab holding the coupler's rotational position is not broken; units with a broken locking tab should not be used.

WARNING LABELS

Warning symbols are displayed at various positions in the vehicle. **SRS** components have additional warning labels displayed on them to indicate that particular care is needed when handling them. These include airbag modules, **SRS ECU**, seat belt pre-tensioners and the rotary coupler.

The following warning symbols may be displayed at various locations on the vehicle:

General Information



S003008

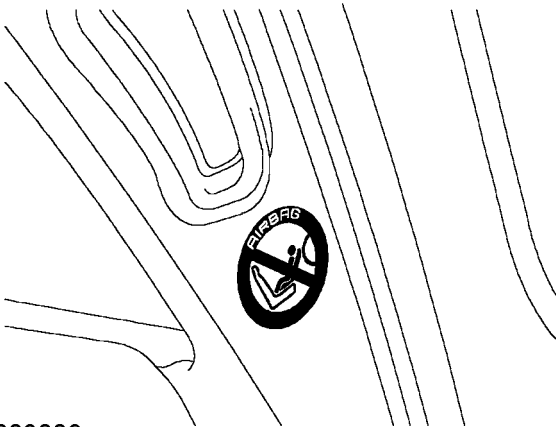
A The need for caution when working in close proximity to SRS components.

B Refer to the publication where the procedures, instructions and advice can be found (usually Workshop Manual or Owner's Handbook) for working on the SRS system.

C Do not use rear facing child seats in the front passenger seat if the vehicle is fitted with a passenger airbag.

Warning: It is imperative that before any work is undertaken on the SRS system the appropriate information is read thoroughly.

The following list indicates possible locations and content for warning labels. Exact positions and content may vary dependent on model year, legislation and market trends.



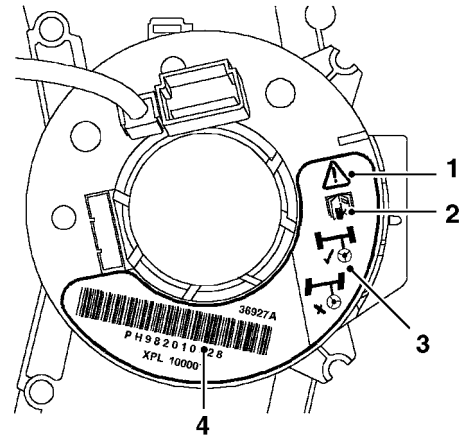
S003009

Do not use rear facing child seat in front passenger seat of vehicles fitted with passenger airbag.

Rotary coupler

1. The need for caution when working in close proximity to SRS components.
2. Refer to Workshop Manual for detailed instructions.
3. Ensure the wheels are in the straight ahead position before removal and refitting.

4. Bar code. The code number must be recorded if the rotary coupler is to be replaced.



S003011

Bar codes

Bar codes are fitted to SRS system components and components which are critically related to SRS operation. The code number(s) must be recorded if the component is to be replaced.

Components featuring bar codes include the following:

- Driver's front airbag module – label attached to rear of module housing
- Passenger front airbag module – label attached at side of module housing
- **SRSECU** Included **SRSECU** on label on top of ECU
- Rotary coupler – several labels on front face

VEHICLE RECOVERY

Towing SRS components not deployed

Normal towing procedures are unlikely to cause an airbag to deploy. However, as a precaution, remove the handset from the docking station and then disconnect both battery leads. Disconnect the negative '-' lead first.

Towing SRS components not deployed

Once the driver's airbag has been deployed, the vehicle must have a suspended tow. However, as a precaution remove the handset from the docking station and then disconnect both battery leads. Disconnect the negative - lead first.

SRS components deployed

If a vehicle is to be scrapped and contains an undeployed airbag module, the module must be manually deployed.

Always observe the following precautions:

Warning: Only personnel who have undergone the appropriate training should undertake deployment of airbag and seat belt pre-tensioner modules.

Warning: A deployed airbag or seat belt pre-tensioner is very hot, DO NOT return to a deployed airbag module until at least 30 minutes have elapsed since deployment.

Warning: Only use approved deployment equipment, and only deploy SRS components in a well-ventilated designated area. Ensure SRS components are not damaged or ruptured before deployment.

Warning: Contact with chemicals from deployed and damaged SRS components could present a health hazard, wear protective clothing when handling. DO NOT eat, drink or smoke when handling SRS components.

Warning: Deployment of airbag modules and seat belt pre-tensioners can cause injury to personnel in the close vicinity of the deploying unit. In case of injury seek urgent medical advice. Possible sources of injury include:

- impact - due to inflating airbag or pretensioner operation causing component 'kick'.
- hearing - due to noise produced by deploying airbags and seat belt pretensioner units.
- burns - hot component parts and gases.
- irritation to eyes and lungs - from deploying gases or combustion residue.

Warning: Ensure the SRS component to be deployed is securely fastened to its mounting.

Warning: Compliance with the following precautions **MUST** be ensured:

- Only use deployment equipment approved for the intended purpose.
- Before commencing deployment procedure, ensure the deployment tool functions properly.
- Deployment of airbag/pre-tensioner modules should be performed in a well ventilated area which has been designated for the purpose.
- Ensure airbag/pre-tensioner modules are not damaged or ruptured before attempting to deploy.
- Notify the relevant authorities of intention to deploy airbag and pretensioner units.
- When deploying airbag and seat belt pre-tensioner units, ensure that all personnel are at least 15 metres away from the deployment zone.
- When deploying seat belt pretensioners in the vehicle, ensure the pre-tensioner unit is fully secured to its fixing point.
- When removing deployed airbag and seat belt pre-tensioner modules, wear protective clothing. Use gloves and seal deployed units in a plastic bag.
- Following deployment of any component of the SRS system within the vehicle, all SRS components must be replaced. DO NOT re-use or salvage any parts of the SRS system.
- Do not lean over airbag modules or seat belt pre-tensioner units when connecting deployment equipment.

General Information

SRS Component Replacement Policy

Impacts Which Do Not Deploy The Airbags or Pre-tensioners

Check for structural damage in the area of the impact, paying particular attention to bumper armatures, longitudinals, crash cans and bracketry.

Impacts Which Deploy The Airbags or Pre-tensioners

The replacement and inspection policy is dependent on the type and severity of the crash condition. **SRS**. The following guidelines are the minimum that should be exercised as a result of the deployment of specific SRS components:

Front airbag deployment (driver and passenger)

If the front airbags are deployed, the following parts must be replaced:

- Driver airbag module
- Passenger airbag module
- Flyleads (where applicable) connecting **SRS** front airbag modules to SRS harness
- Seat belt pre-tensioners
- Driver's seat belt retractor
- Rotary coupler
- **SRS ECU**

In addition, the following should be inspected for damage and replaced as necessary:

- Front passenger's seat belt retractor (webbing, tongue latching, 'D' loop, body anchorage point)
- Rear seat belt buckles (webbing, buckle covers, body anchorage and tongue latching function)
- Fascia moulding adjacent to passenger airbag module
- Steering wheel (if damage is evident)
- Front seat frames and head restraints (if there is evidence of damage to the seat frame or cushion pan)
- Steering column (if adjustment is lost or there are signs of collapse)
- Seat belt automatic height adjusters on 'BC' posts
- Rear seat belt escutcheons in parcel shelf trim

Side (Thorax) airbags

If the side (thorax) airbags are deployed, the following parts must be replaced, on the side of the vehicle on which the deployment occurred:

- Seat (thorax) airbag module
- Seat squab foam
- Seat squab cover
- Front seat belt buckle pre-tensioners

- **SRS ECU**
- Side impact crash sensors (both sides of vehicle)

In addition, the following should be inspected for damage and replaced as necessary:

- Front seat belts (retractors, webbing, tongue latching, 'D' loop and body anchorage points)
- Rear seat belt buckles (webbing, buckle covers, tongue latching and body anchorage)
- Front seat frame (if there is evidence of external or airbag deployment damage to seat frame)
- 'BC' post internal finishers and fixings
- Door casings
- Seat belt automatic height adjusters on 'B' post
- Rear seat belt escutcheons in parcel shelf trim

Inflatable Curtain Structure (ICS) Airbags modules

If the Inflatable Curtain Structure airbag modules are deployed, the following parts must be replaced, (**ICS**) on the side of the vehicle for which deployment occurred:

- **ICS** airbag module
- Link lead between airbag gas generator **SRS** and SRS harness
- Airbag retaining clips above window aperture
- 'A' post internal finisher
- Front seat belt pre-tensioners
- **SRS ECU**
- Side impact crash sensors (both sides of vehicle)

In addition, the following should be inspected for damage and replaced as necessary:

- Headlining
- **ICS** mounting brackets
- Alarm sensor
- Front seat belts (retractors, webbing, tongue latching, 'D' loop and body anchorage points)
- Rear seat belt buckles (webbing, buckle covers, tongue latching and body anchorage)
- 'BC' post upper finisher and fixings
- Door casing
- Seat belt automatic height adjusters on 'B' post
- Rear seat belt escutcheons in parcel shelf trim

Rear impacts

Rear impacts may cause the seat belt pretensioners to deploy. If this occurs, all pretensioner units must be replaced. In addition, the following components should be inspected for damage and replaced as necessary:

- Front seat frames
- Seat belt automatic height adjusters on 'B'- post
- Front seat belts (retractors, webbing, tongue latching, 'D' loop and body anchorage points)
- Rear seat belt buckles (webbing, buckle covers, tongue latching and body anchorage)
- Rear seat belt escutcheons in parcel shelf trim
- **SRS ECU**

Periodic Replacement of SRS Components

The performance of the propellants within airbags and pre-tensioners will deteriorate over a period of time. As a result, it is essential that the airbags and pre-tensioners are periodically replaced to maintain occupant safety. Airbags, seat belt pre-tensioners and the rotary coupler should be replaced at 12 year intervals.

Air Conditioning System Precautions

General

The air conditioning system contains fluids and components which could be potentially hazardous to the service engineer or the environment if not serviced and handled correctly. The following guidelines are intended to alert the service engineer to potential sources of danger and emphasise the importance of ensuring the integrity of the air conditioning operating conditions and components fitted to the vehicle.

Where necessary, additional specific precautions are detailed in the relevant sections of this Manual which should be referred to prior to commencing repair operations.

The refrigerant used in the air conditioning system is HFC-134a (Hydrofluorocarbon) R134a.

Warning: Servicing must only be carried out by personnel familiar with both the vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.

Warning: R134a is a hazardous liquid and when handled incorrectly can cause serious injury. Suitable protective clothing, consisting of face protection, heat-proof gloves, rubber boots and rubber apron or waterproof overalls, must be worn when carrying out operations on the air conditioning system.

Remedial Actions

If an accident involving R134a should occur, conduct the following remedial actions:

- If liquid R134a enters the eye, do not rub it. Gently run large quantities of eye wash over affected eye to raise the temperature. If an eye wash is not available, cool, clean water may be used to flush the eye. After rinsing, cover the eye with a clean pad and seek immediate medical attention.
- If liquid R134a is splashed onto the skin, run large quantities of water over the affected area to raise the temperature. Implement the same action if the skin comes in contact with discharging cylinders. Wrap the contaminated body parts in blankets (or similar materials) and seek immediate medical attention.
- If the debilitating effects of inhalation of R134a vapour is suspected, seek fresh air. If the affected person is unconscious, move them away from the contaminated area to fresh air and apply artificial respiration and/ or oxygen and seek immediate medical attention.

General Information

Warning: Due to its low evaporating temperature, R134a must be handled with care. R134a splashed on any part of the body will cause immediate freezing of that area. Also, refrigerant cylinders and replenishment trolleys when discharging will freeze skin to them if contact is made.

Service Precautions

Observe the following precautions when handling components used in the air conditioning system:

- Air conditioning units must not be lifted by their hoses, pipes or capillary lines.
- Hoses and lines must not be subjected to any twist or stress; the efficiency of the system will be impaired by kinks or restrictions. Ensure that hoses are correctly positioned before tightening couplings, and ensure that all clips and supports are utilised.
- Flexible hoses should not be positioned close to the exhaust manifold (less than 100 mm) unless protected by heat shielding.
- Completed assemblies must be checked for refrigeration lines touching metal panels. Any direct contact of components and panels may transmit noise and so must be eliminated.
- The appropriate torque wrench must be used when tightening refrigerant connections to the stipulated value. An additional spanner must be used to hold the union to prevent twisting of the pipe when tightening connections.
- Before connecting any hose or pipe, ensure that refrigerant oil is applied to the seat of the new O-rings, BUT NOT to the threads of the connection.
- All protective plugs must remain in place to seal the component until immediately prior to connection.
- Ensure components are at room temperature before uncapping, to prevent condensation of moisture from the air that enters it.
- Components must not remain uncapped for longer than 15 minutes. In the event of a delay, the caps must be fitted.
- When disconnecting, immediately cap all air conditioning pipes to prevent ingress of dirt and moisture into the system.
- The receiver/drier contains desiccant which absorbs moisture. It must be positively sealed at all times. A receiver/drier that has been left uncapped must not be used, fit a new unit.
- The receiver/drier should be the last component connected to the system to ensure optimum dehydration and maximum moisture protection of the system.

- Whenever the refrigerant system is opened, the receiver/drier must be renewed immediately before evacuating and recharging the system.
- Use alcohol and a clean lint-free cloth to clean dirty connections.
- Ensure that all new parts fitted are marked for use with R134a.

Refrigerant oil

Refrigerant oil easily absorbs water and must not be stored for long periods. Do not pour unused refrigerant oil back into the container. Always use an approved refrigerant oil.

When replacing components in the A/C system, drain the refrigerant oil from the component being replaced into a graduated container. On assembly, add the quantity of refrigerant oil drained to the new component.

Compressor

A new compressor is sealed and pressurised with Nitrogen gas. When fitting a new compressor, slowly release the sealing cap; gas pressure should be heard to vent as the seal is broken.

Caution: Do not remove the cap(s) until immediately prior to connecting the air conditioning pipes to the compressor.

Rapid refrigerant discharge

If the air conditioning system is involved in accident damage and the system is punctured, the refrigerant will discharge rapidly. The rapid discharge of refrigerant will also result in the loss of most of the oil from the system. The compressor must be removed and all the remaining oil in the compressor drained and refilled as instructed in the air conditioning section of this manual.

Precautions for Refrigerant Recovery, Recycling and Recharging

When the air conditioning system is recharged, any existing refrigerant is first recovered from the system and recycled. The system is then charged with the required weight of refrigerant and volume of refrigerant oil.

Warning: Refrigerant must always be recycled before re-use to ensure that the purity of the refrigerant is high enough for safe use in the air conditioning system.

Warning: Recycling should always be carried out with equipment which is design certified by Underwriter Laboratory Inc. for compliance with SAE J1991. Other equipment may not recycle refrigerant to the required level of purity.

Warning: A R134a Refrigerant Recovery Recycling Recharging Station must not be used with any other type of refrigerant.

Warning: Refrigerant R134a from domestic and commercial sources must not be used in motor vehicle air conditioning systems.

Caution: The system must be evacuated immediately before recharging commences. Delay between evacuation and recharging is not permitted.

Air Conditioning Compressor Replacement Replacement Instructions

A new compressor is supplied filled with a full charge of refrigerant oil. The new compressor must be drained and a calculated quantity of oil added before fitting. To calculate the quantity of oil to be added, carry out the following procedure:

1. Remove the filler/drain plug from the old compressor.
2. Invert the compressor and gravity drain the oil into a calibrated measuring cylinder. Rotate the compressor clutch to ensure the compressor is completely drained.
3. Record the quantity of oil drained, discard the oil.
4. Remove the filler/drain plug from the new compressor.
5. Invert the compressor and gravity drain the oil into a calibrated measuring cylinder. Rotate the compressor clutch to ensure the compressor is completely drained.
6. Add the same amount of oil drained from the old compressor to the new compressor.
7. Discard the remaining oil drained from the new compressor.
8. Fit and tighten the compressor filler/drain plug.

Lifting & Towing

Lifting

Lifting Description

Note the following points before lifting the vehicle from the ground.

- The vehicle should be parked on a level and hard surface.
- Apply the hand brake.
- The transmission is in P or N.

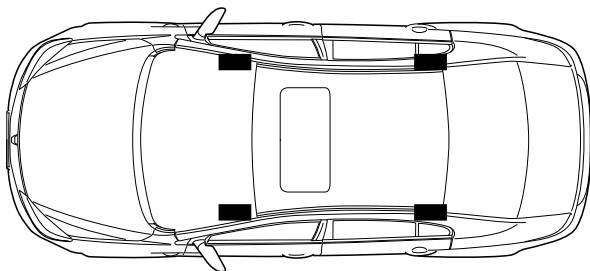
To prevent the lower body components of the vehicle from being damaged, be sure to follow the support procedures below:

DO NOT place the jack or the axle support under the following components:

- Body Structural Member
- Bumper
- Fuel Line
- Brake Line
- Front Suspension Arm
- Steering Linkage
- Rear Suspension Arm
- Fuel Tank
- Engine Oil Pan
- Transmission Case
- Rear Towing Pad

Front and Rear Supporting Points of Vehicle

The jack provided in the vehicle is only used to replace wheels in an emergency. Never use it for other purposes.



S003089

If the jack provided in the vehicle is used for replacing wheels, be sure to place the jack on a hard level surface and position it under the supporting point near the wheel to be removed. Note that the snap head of the jack must be placed in the appropriate groove of the deck.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

Hydraulic Jack

The hydraulic jack must have a load capacity of at least 1500 kg (3300 lbs).

Warning: DO NOT work under the vehicle until it is safely and reliably supported.

Warning: Always chock the wheels with chocks when using the jack.

Lifting and Supporting Vehicle

Front Supporting Point of the Hydraulic Jack

For side: Place the head of the jack on the supporting points of the front and rear sills on the vehicle (See the illustration for the lifting points of the vehicle).

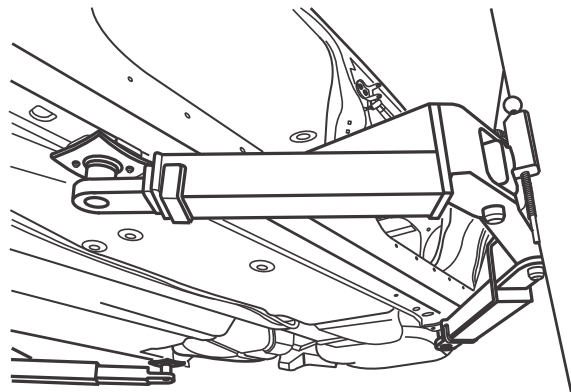
Caution: Only use a jack with a snap head at the lifting points. The snap head of the jack must be seated into the corresponding groove in the base board.

Caution: Only jack or support the vehicle on the designated location. Otherwise, it may cause the body or chassis components to damage.

Warning: DO NOT work under the vehicle until it is safely and reliably supported.

Warning: Always chock the wheels with chocks when using the jack.

Pillar Type Lift



S003031

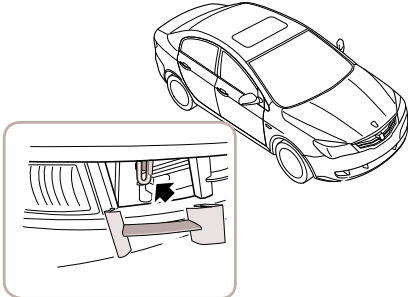
Place a cushion under the sill lifting point.

Vehicle Rescue

Rescue Description

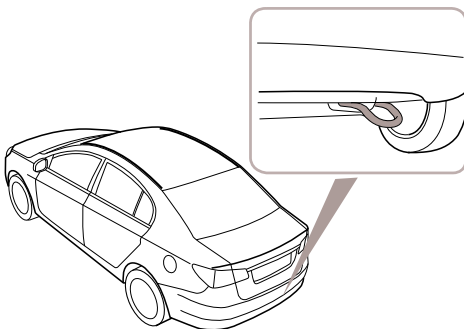
It is recommended that emergency trailer or 2-wheel emergency vehicle should be used. During an emergency, tow the vehicle with the front towing point.

Front Towing Pad



The front of the vehicle is equipped with a removable pintle hook which is used during the vehicle rescue. The front pintle hook is usually stored in the vehicle tool box, and it should be put back after being used. When fitting the pintle hook, remove the pintle hook cover on the right side of the front bumper first, and then tighten the pintle hook to the mounting parts (bumper armature) of the front bumper assembly.

Rear Pintle Hook



Fixed rear pintle hook can only be used for towing light-weight vehicles. The rear towing point of the vehicle equipped with a manual transmission can be used for towing from the rear.

Caution: A rear pintle hook must not be used for vehicles with an automatic transmission, which will cause the automatic transmission to damage seriously.

Manual Transmission

Tow the four wheels from the front of the vehicle with the towing pad.

Before towing, release the hand brake and turn the ignition switch to the ON position with the shift lever in N. The towing speed should be less than 30 mph (50 km/h).

Make sure to follow the precautions below:

In order to make sure the steering ability still exists when the vehicle is being towed, it is necessary to insert the ignition key, turn it to the "ON" position and maintain this state when the vehicle is moving.

- DO NOT tow the vehicle when the transmission or drive shaft has a problem.
- Make sure the shift lever is in neutral position and the parking brake is released.
- If the engine does not operate when towing vehicle, be more careful to operate the brake and the steering system.

Caution: If the transmission case occurs malfunction and the transmission fluid level is too low or the towing distance is above 30 miles (50 km), the four wheels of the vehicle cannot be towed absolutely.

Automatic Transmission

Generally, the automatic transmission vehicle should be towed by the trailer with front wheels off the ground (front wheels are raised).

Caution: A rear suspended towing must not be used, which will cause the automatic transmission to damage seriously.

In order to make sure the steering ability still exists when the vehicle is being towed, it is necessary to insert the ignition key, and turn it to the "ON" position and maintain this state when the vehicle is moving.

When towing the vehicle equipped with an automatic transmission from the front, be sure to note the following points:

Warning: When towing the vehicle.

- The shift lever must be in "N" position.
- The towing speed of the vehicle cannot exceed 30 mph (50 km/h) or the towing distance cannot exceed 30 mile (50 km).
- DO NOT tow the vehicle when the transmission or drive shaft is faulty.
- Make sure the shift lever is in neutral position and the parking brake is released.
- If the vehicle is being towed without the engine running, take extra care to operate the brake and steering.

Caution: DO NOT tow on four wheels if the transmission or drive shafts are touching the body or frame.

Note: A vehicle with an automatic transmission cannot be started by towing or pushing.

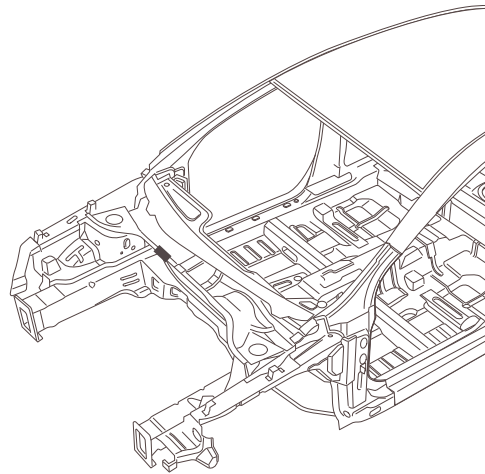
Vehicle Identification Number

Vehicle Identification Number

Vehicle Identification Number (VIN)

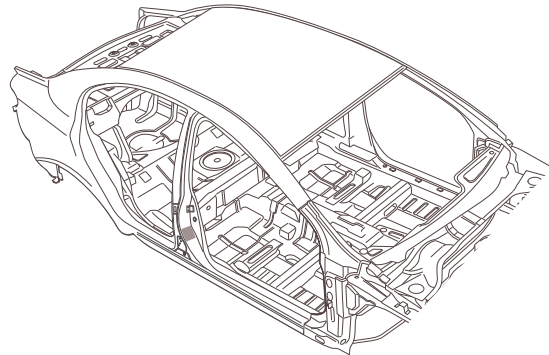
Examples: LSJA16E3X9G

| | |
|---|--|
| LSJ | Code of the Vehicle Manufacturer |
| AI | Model/Type |
| 6 | Body structure features 6 = 4 doors etc. |
| E | Engine E = 1.5 VCT gasoline engine |
| 3 | Occupant Restraint System 3 = Seat belt, driver and front passenger frontal airbags |
| X | Check digit, shown by any number of 0-9 or letter X |
| 9 | Vehicle productive year 9=2009 |
| G | Assembly plant G = Pukou, Nanjing P.R.China |
| 6-digit number = Sequential production number | |



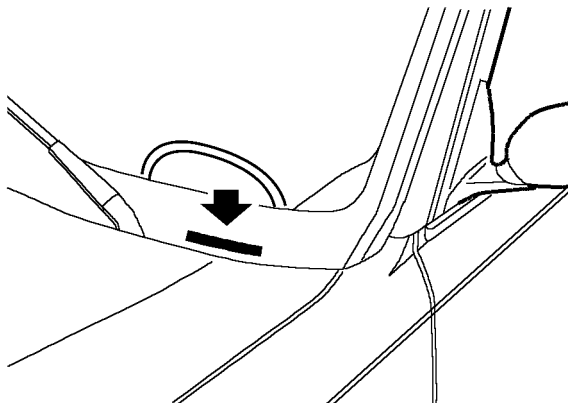
The top of the front suspension support table RH.

Vehicle Identification Plate Location



The vehicle identification plate is hung on the outside of the B/C pillar LH.

VIN is also stamped on the positions below:



S003020

Flat surface on back of the left bottom of the windshield.

| | | | |
|----------------|-------------------|------|---------|
| 1 | | 2 | |
| 荣威牌轿车 | | | |
| 车辆型号 | CSA7150AC | 乘坐人数 | 5 |
| 发动机型号 | 1584U | 制造年月 | 2010.06 |
| 发动机排量 | 1495ml | 总质量 | 1655kg |
| 发动机额定功率 | 78kW | 制造国 | 中国 |
| 车辆识别代号 | LSJA16E3X9G145262 | | |
| 7 上海汽车集团股份有限公司 | | | |

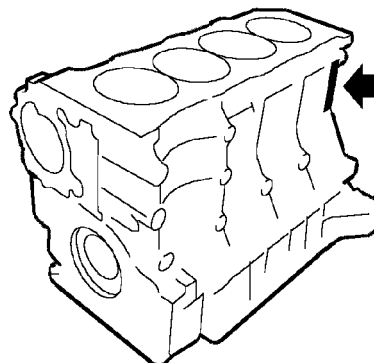
S003112

The vehicle identification plate contains the following information:

1. Vehicle Type
2. Seating Capacity
3. Manufacturing Date
4. Gross Vehicle Weight
5. Manufacturing Country
6. Vehicle Identification Number (**VIN**)

- 7. Manufacturing Company
- 8. Engine Rated Power
- 9. Engine Displacement
- 10. Engine Type

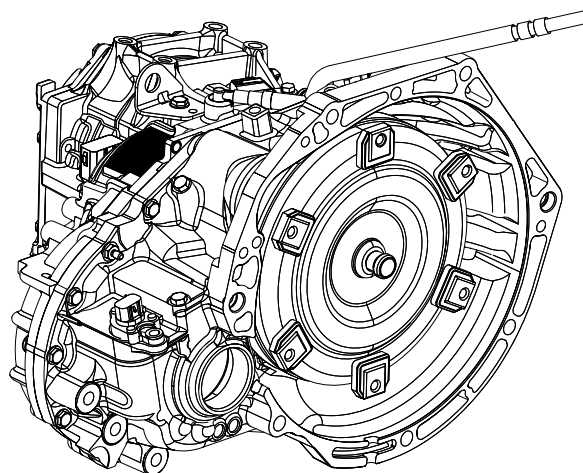
**Other Identification Plate Location
Engine Number**



S003028

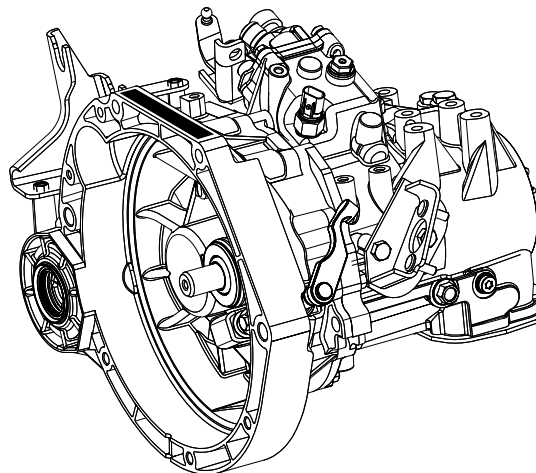
This number is stamped on the left behind of the block.

Automatic Transmission Number



This number is stamped on the top surface of the transmission case.

Manual Transmission Number



This label is pasted on the left of the transmission case.

Lubrication & Maintenance

Capacity

Fluid Capacity

The table below shows the approximate capacity values of the fluid with which appropriate system should be filled.

| Component/System | Capacity |
|-----------------------------------|----------|
| Fuel Tank: | |
| Available | 55 L |
| Dry Fill | 56 L |
| Engine - 1.5L: | |
| Engine Oil and Filter Replacement | 4.5 L |
| Manual Transmission: | |
| Fill | 2 L |
| Dry Fill | 2.2 L |
| Automatic Transmission: | |
| Fill | 2.9 L |
| Cooling System - 1.5 L Engine: | |
| Dry Fill | 7.3 L |
| MT Brake System Fluid (Dry fill) | 0.75 L |
| AT Brake System Fluid (Dry fill) | 0.5 L |
| Windshield Washer Tank | 3.8 L |

Fluid

Fuel

Always use the following recommended fluids:

Gasoline Engine

Use the Number **93RON** high quality unleaded gasoline or higher. DO NOT use the gasoline that contains carbinol.

Antifreeze

Use the mixture that contains 50% water and 50% **OAT**. The antifreeze (contains anti-corrosion agent with organic acid technology (**OAT**)) and coolant used in summer or antifreeze based on ethylene glycol (non-carbinol) are used to protect the cooling system. Only the antifreeze that contains the OAT anti-corrosion agent can be used.

DO NOT use other types of antifreeze to replenish or charge the cooling system. In an emergency, if this type of antifreeze is not available, the cooling system can only be charged with pure water. But please note that this will reduce the frost protection ability. The antifreeze density should be corrected as soon as possible.

When the checking time listed in the service check sheet is reached, drain and clean the cooling system, then charge the system with proper amount of antifreeze.

After charging, paste a warning label instructing the type of the antifreeze on the vehicle on a position visible to make sure that the antifreeze being used next time is correct.

Antifreeze Density

The density of antifreeze should not be less than 50% of the capacity, make sure the anti-corrosion characteristic of the antifreeze is possible. It is recommended that the density of antifreeze should not exceed 60%, otherwise the cooling performance will decrease.

The capacity of antifreeze recommended in the table below will provide frost protection at -37°C to 40°C.

Engine - 1.5L:

| | |
|---------------------|-------|
| Density | 50% |
| Antifreeze Capacity | 7.3 L |

Brake Fluid/Clutch Fluid

Only DOT4 brake fluid can be used.

PAS Fluid

Use the fluid that meets the specification of Dexron III.

Lubricant

Overall

Engine and the other lubrication system are filled with high performance lubricant to extend their lives.

Caution: Always use a high quality oil of the standard viscosity range for the engine. Using the oil on incorrect specification can lead to high oil / fuel consumption and ultimately cause the components to be damaged.

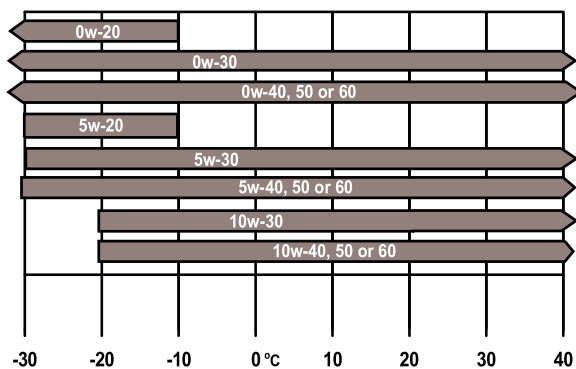
Using the recommended oil that contains additive can reduce the corrosive acid produced by burning and prevent the residual forming, which will block the oil passage. Other oil additive cannot be used.

The service and maintenance must be performed within the specified interval.

Engine Oil

Use the 5w/40 oil which meets the ACEA A3/B3 specification.

For the engine oil viscosity/temperature range, refer to the following table:



Ambient temperature range

Transmission Oil

If the transmission oil is not as specified, the transmission may be seriously damaged.

Manual Transmission

It should be charged or filled with MTF94 oil.

Automatic Transmission

Use JW-S3309 (Exxon Mobile).

General Grease

Use the FN745/94 grease produced by Fuchs.

Bonnet Lock Body

Use the FN745/94 grease produced by Fuchs.

Lock, lock body and hinge

DO NOT apply the grease to the fixed end of the torsion bar spring, but the KLUBER Isoflex Topas L32CN grease is first recommended for the rotated end.

Washer Fluid

Use the QX-35 washer fluid.

Engine Mechanical

Specifications

Torque

| Description | Value |
|---|-----------------------------|
| Bolt - Air Cleaner Bracket to Body | 5-7 Nm |
| Bolt - Battery Tray to Body | 40-50 Nm |
| Bolt - Engine Mounting to Cylinder Block | 40-50 Nm |
| Bolt - Flywheel to Crankshaft | (32–38)Nm + 60° |
| Bolt - Crankshaft Damper to Crankshaft | 60 Nm + 120° |
| Bolt - Timing Chain Upper Cover Plate to Cylinder Head (M6 x 35) | 8-12 Nm |
| Bolt - Timing Chain Lower Cover Plate to Cylinder Block and Lower Crankcase | 8-12 Nm |
| Bolt - Chain Guide Rail and Tensioner Guide Rail | 22-28 Nm |
| Bolt - Upper Guide Rail to Cylinder Head Front Camshaft Bearing Cap | 8–12 Nm |
| Bolt - Timing Chain Tensioner to Cylinder Head | 57-63 Nm |
| Bolt - Exhaust Camshaft Sprocket to Camshaft | 25 Nm + 45° |
| Bolt - Intake Phase Modulator to Camshaft | 70-80 Nm |
| Bolt - Oil Pump Sprocket to Oil Pump | 22-28 Nm |
| Bolt - Camshaft Bearing Cap to Cylinder Head | 8-12 Nm |
| Bolt - Ignition Coil | 8–12 Nm |
| Bolt - Cylinder Head to Cylinder Block | 30 Nm + 90°+ 90°+ 45° |
| Bolt - Cylinder Head Chain Case to Cylinder Block | 10-12 Nm |
| Bolt - Oil Control Valve to Cylinder Head | 5-7 Nm |
| Bolt - Thermostat Cover to Cylinder Head | 8-12 Nm |
| Bolt - Alternator to Cylinder Head | 40-50 Nm |
| - Spark Plug | 20-30 Nm |
| Bolt - Timing Chain Upper Cover Plate to Cylinder Head (M6 x 20) | 8-12 Nm |
| Bolt - Lower Crankcase to Cylinder Block | 22-30 Nm |
| Bolt - Main Bearing Cap to Cylinder Block | (20 ± 2) Nm + 90°+(45 ± 2)° |
| Bolt - Connecting Rod | (18 ± 2) Nm + (90 ± 5)° |
| Bolt - Crankshaft Rear Oil Seal | 8-12 Nm |
| Bolt - Oil Pump to Lower Crankcase | 8-12 Nm |
| Bolt - Oil Baffle to Lower Crankcase | 8-12 Nm |
| - Oil Filter | 16–18 Nm |
| Plug - Lower Crankcase Drain | 35-40 Nm |

Parameter**I.5VCT - Overall**

| | |
|--|---|
| Type | 1.5-liter gasoline engine, 16-valve, double overhead camshaft, variable intake cam timing |
| Cylinder Layout | 4-cylinder, in-line, transverse, the first cylinder in the front of the engine |
| Cylinder Bore Diameter | 75.00 mm |
| Stroke | 84.80 mm |
| Displacement | 1,498 cm ³ |
| Firing Order | 1 - 3 - 4 - 2 |
| Compression Ratio | 10.5:1 |
| Rotating Direction | Rotating clockwise when viewed from the front of the engine |
| Rated Power | 80 kW @ 6,000 rev/min |
| Maximum Torque | 135 Nm @ 4,500 rev/min |
| Idle Speed | 750±50 rev/min |
| Maximum Engine Speed | 7,000 rev/min |
| Weight (without oil, PAS, A/C and clutch assembly) | 116 kg (MT), 111 kg (AT) |

I.5VCT - Crankshaft

| | |
|----------------------------|--|
| Crankshaft | |
| Crankshaft End Play | 0.205±0.1 mm |
| Service Value Limit | 0.34 mm |
| Main Journal Diameter: | |
| Class A | 53.690-53.700 mm |
| Class B | 53.680-53.690 mm |
| Main Journal Tolerance: | |
| Class 0 | 49.993-50.000 mm |
| Class I | 49.992-49.984 mm |
| Pin Journal Diameter | 48.000-47.984 mm |
| Maximum Out-of-round | 0.008 mm |
| Main Bearing: | |
| Quantity | 5 on top and 5 at bottom |
| Type | Steel shell layer, antifriction alloy, the upper half of bearing has oil passages. |
| Thrust Plate | Half-plate washers are on both of the left and right thrust sides of the third main bearing and adhere to the thrust surfaces. |
| Thickness of Thrust Washer | 2.810-2.855 mm |
| Bearing Backlash | 0.020-0.054 mm |

I.5VCT - Cylinder Block and Piston

| | | | |
|--|---------------|---|--------------------------------------|
| Cylinder Block: | | | |
| Material | | Cast iron, HT250 | |
| Cylinder Liner Type | | Plateau honing checker liner | |
| Cylinder Liner Diameter | | 74.985-75.000 mm | |
| Cylinder Block Correction Size: | | | |
| | Bore | Maximum Diameter of Skirt Portion of Piston | Gap between Piston and Cylinder Bore |
| Normal Size | 74.985-75.000 | 74.941-74.959 | 0.026-0.059 |
| A (+0.5) | 75.485-75.500 | 75.441-75.459 | 0.026-0.059 |
| B (+1.0) | 75.985-76.000 | 75.941-75.959 | 0.026-0.059 |
| C (+1.5) | 76.485-76.500 | 76.441-76.459 | 0.026-0.059 |
| Connecting Rod: | | | |
| Type | | Fractured connecting rod, Material C70S6 | |
| Distance between Centres | | 143.7±0.05 mm | |
| Piston Pin Type | | Semi-floating | |
| Fitted into Connecting Rod | | Interference | |
| Length | | 51.7-52.0 mm | |
| Connecting Rod Bearing: | | | |
| Gap | | 0.020-0.071 mm | |
| Axial Play | | 0.100-0.246 mm | |
| Piston: | | | |
| Type | | Aluminum alloy, surface graphitized, deviating toward the piston pin during thermal expansion | |
| Piston Diameter: | | 74.941-74.959 mm | |
| Piston Pin Opening Tolerance | | 0.009-0.020 mm | |
| Maximum Ovality | | 0.002 mm | |
| Piston Ring: | | | |
| Type: | | 2 compression rings, 1 oil ring | |
| Top Compression Ring | | Outer circle with eccentric barrel face, surface nitrided | |
| 2nd Compression Ring | | Nose shape, and surface bonderized | |
| Oil Ring | | Spring nitrided, the side rail nitridized and then bonderized | |
| Tolerance from Piston Ring to Ring Groove: | | | |
| Top Compression Ring | | 0.040-0.080 mm | |
| 2nd Compression Ring | | 0.030-0.062 mm | |
| Oil Ring | | 0.015-0.045 mm | |

| | |
|---|----------------|
| Piston Ring End Gap (Measure at 20 mm from the cylinder liner opening): | 0.25-0.40 mm |
| Top Compression Ring | 0.37-0.57 mm |
| 2nd Compression Ring | 0.10-0.60 mm |
| Oil Ring | |
| Width of Piston Ring Groove: | |
| Top Compression Ring | 0.970-0.990 mm |
| 2nd Compression Ring | 1.170-1.190 mm |
| Oil Ring | 1.880-1.980 mm |

I.5VCT Cylinder Head and Valve

| | |
|---|---|
| Cylinder Head: | |
| Material | Aluminum alloy |
| Cylinder Head Bend - Maximum | 0.05 mm |
| Cylinder Head Height: | |
| New | 118.95-119.05 mm |
| Finish Limit | 0.20 mm |
| Camshaft: | |
| Type | Double overhead camshaft which directly acts on the mechanical tappet |
| Bearing | 5 for each camshaft, arranged in line |
| Drive | Chain drive at crankshaft gear |
| Camshaft Thrust Gap: | 0.06-0.19 mm |
| Service Value Limit | 0.30 mm |
| Bearing Backlash: | Front 0.025-0.066 mm, rear 0.024-0.066 mm |
| Service Value Limit | 0.15 mm |
| Mechanical Tappet: | |
| Type | Mechanical tappet, directly driven by the camshaft |
| Outer Diameter of Mechanical Tappet | f 29.964 mm-f 29.980 mm |
| Valve Timing: | |
| Intake Valve: | |
| Open | 22°ATDC |
| Close | 68°ABDC |
| Maximum Lift | 7.7 mm |
| Exhaust Valve: | |
| Open | 45°BBDC |
| Close | 11°ATDC |
| Maximum Lift | 8.2 mm |
| Valve: | |
| Valve Stem Diameter: | |
| Intake Valve | f 5.952-f 5.967 mm |
| Exhaust Valve | f 5.947-f 5.962 mm |
| Gap between Valve Stem and Valve Guide: | |
| Intake Valve | 0.033-0.073 mm |
| Exhaust Valve | 0.038-0.078 mm |

| | |
|--|---|
| Valve Stem Mating Height: | |
| New Intake Valve | 50.021-50.881 |
| New Exhaust Valve | 49.925-50.785 |
| Service Value Limit | 0.26 mm |
| Valve Head Diameter: | |
| Intake Valve | f 29.2-f 29.4 mm |
| Exhaust Valve | f 24.0-f 24.2 mm |
| Valve Seat Width | |
| Intake Valve | 1.0 mm-1.4 mm |
| Exhaust Valve | 1.4 mm-1.8 mm |
| Angle of Valve Seat Surface - Intake Valve and Exhaust Valve | Intake 150°, 90°, 60° Exhaust 150°, 90°, 60° |
| Angle of Valve Surface - Intake Valve and Exhaust Valve | 45° |
| Valve Gap | Intake Valve: 0.11-0.19 mm |
| | Exhaust Valve: 0.20-0.28 mm |
| Valve Spring: | |
| Free Length | 50.0 mm |
| Refit Length | 37.0 mm |
| Assembly Load | 250±12.5 Nm |
| Intake Valve Open Load | 442±18 Nm |
| Exhaust Valve Open Load | 464±18 Nm |

Lubrication

| | |
|---|----------------------------------|
| Lubrication: Type | Cast-aluminum lower crankcase |
| Oil Pump Type: | Rotor pump driven by chain |
| Engagement Gap of Inner and Outer Rotors | 0.03-0.11 mm |
| Gap between Rotor and Pump Cover End Surface | 0.05-0.086 mm |
| Pressure Limiting Valve Spring Free Length | 67.95±1 mm |
| Oil Filter | Rotary type full flow oil filter |
| Cut-off Pressure of 3,500 rev/min Pressure Limiting Valve | 5.4-6.58 bar |

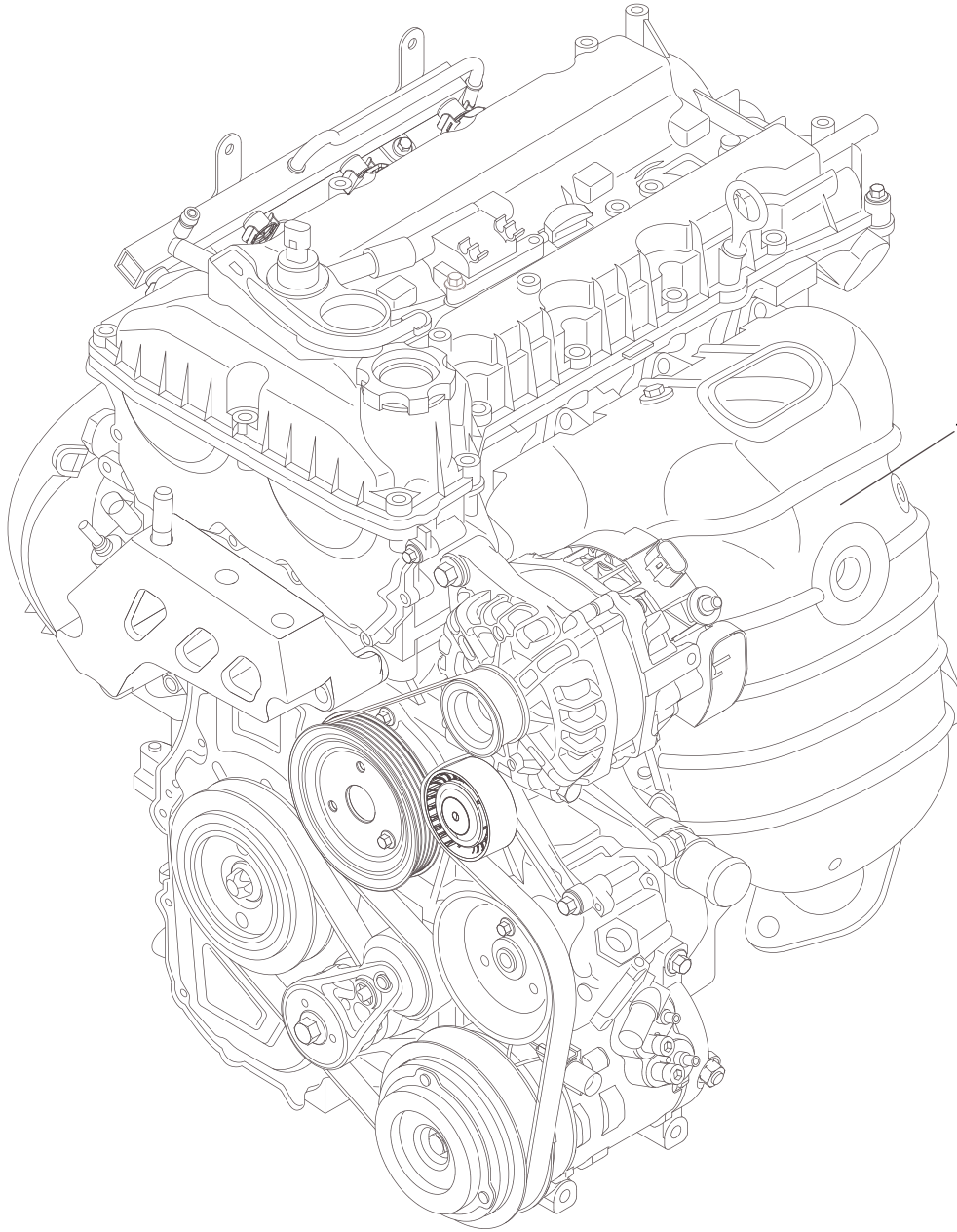
Usage Times of Bolt

| Part No. | Name | Usage Times |
|-----------|--|-------------|
| BLT200010 | Bolt - Main Bearing Cap | Once |
| 90004180 | Screw - Crankshaft Sensor Signal Plate | Once |
| BLT200011 | Bolt - Connecting Rod | Once |
| 90003592 | Bolt - Oil Pump to Oil Pan | Once |
| 90003620 | Stud Bolt - Intake Manifold to Cylinder Head | Once |
| BLT200019 | Cylinder Head Bolt | Once |
| 99000007 | Bolt - Cylinder Head to Cylinder Block | Once |
| BLT200025 | Bolt - Camshaft Sprocket | Once |
| BLT200012 | Bolt - Crankshaft Damper | Once |
| 90004291 | Bolt - Front Cover to Cylinder Head | Once |
| 90000433 | Bolt - Lower Front Cover to Cylinder Block | Once |
| BLT200013 | Bolt - Automatic Gear Flywheel to Crankshaft | Once |
| BLT200013 | Bolt - Flywheel | Once |
| BLT200015 | Bolt - Tensioner | Once |
| 90000829 | Hexagon Flange Bolt - Exhaust Manifold | Once |

Description and Operation

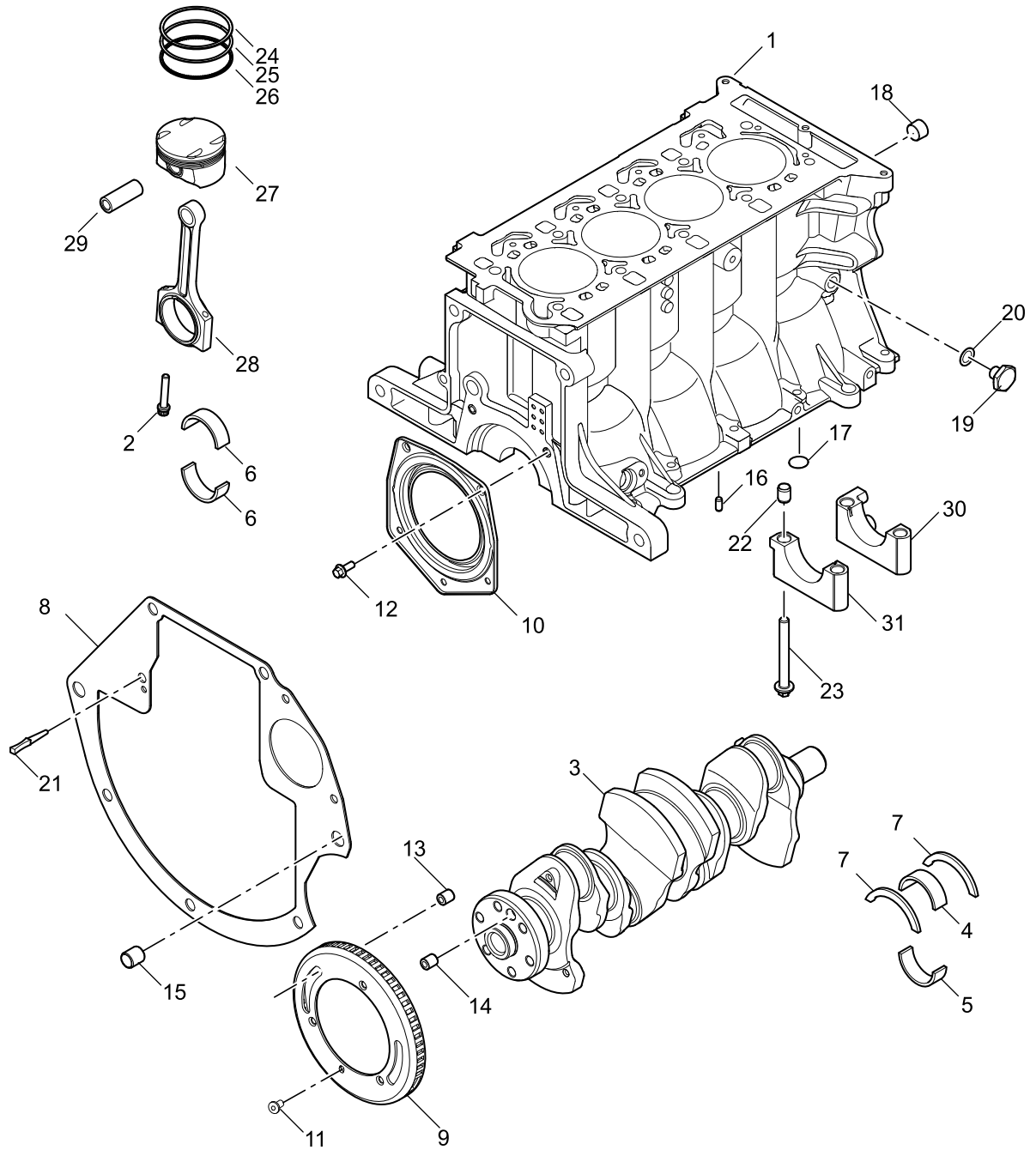
System Component Layout

NSE Engine Component Layout



I. 1.5VCT Engine

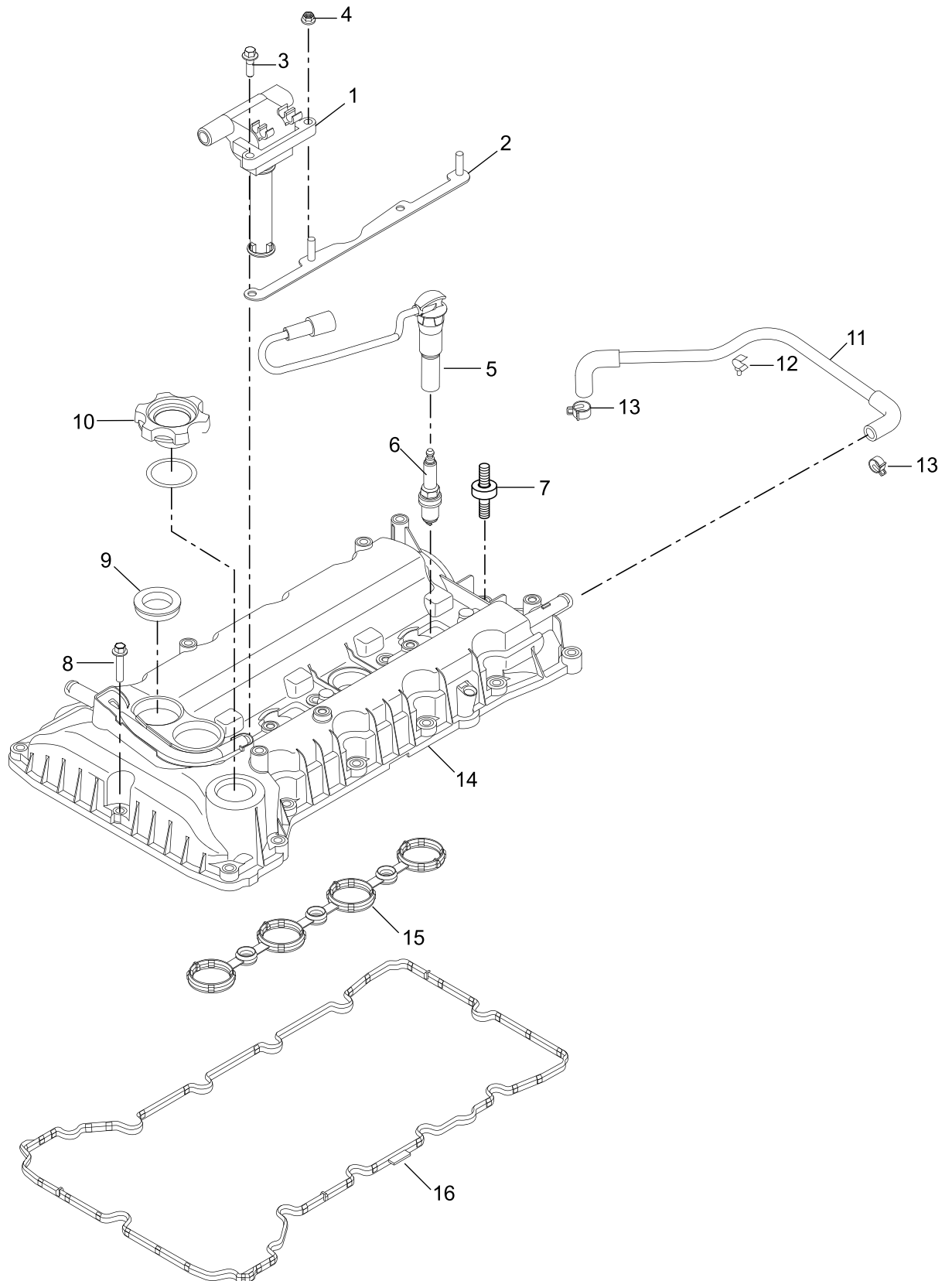
Cylinder Block Exploded View



- | | |
|--|--|
| 1. Cylinder Block | 9. Crankshaft Sensor Signal Plate |
| 2. Bolt - Connecting Rod | 10. Crankshaft Rear Oil Seal |
| 3. Crankshaft Assembly | 11. Screw - Crankshaft Sensor Signal Plate |
| 4. Main Bearing (Upper) | 12. Bolt - Crankshaft Rear Oil Seal |
| 5. Main Bearing (Lower) | 13. Location Pin - Crankshaft Sensor Signal Plate |
| 6. Connecting Rod Big End Bearing | 14. Location Pin - Between Crankshaft and Flywheel |
| 7. Main Bearing Thrust Plate | 15. Location Pin - Cylinder Block to Transmission Case |
| 8. Cylinder Block Rear End Surface Cover Plate | 16. Location Pin - Front Cover to Cylinder Block |

- | | |
|---|----------------------|
| 17. O-ring - Lower Crank Case to Cylinder Block (Oil Passage) | 25. 2nd Ring |
| 18. Plug - Oil Passage | 26. 3rd Ring |
| 19. Plug - Oil Pressure Switch | 27. Piston |
| 20. Washer - Cylinder Block Oil Passage Plug | 28. Connecting Rod |
| 21. Plug - Timing Hole | 29. Piston Pin |
| 22. Location Pin - Main Bearing Cap | 30. Main Bearing Cap |
| 23. Bolt - Main Bearing Cap | 31. Main Bearing Cap |
| 24. Top Ring | |

Camshaft Cover Exploded View

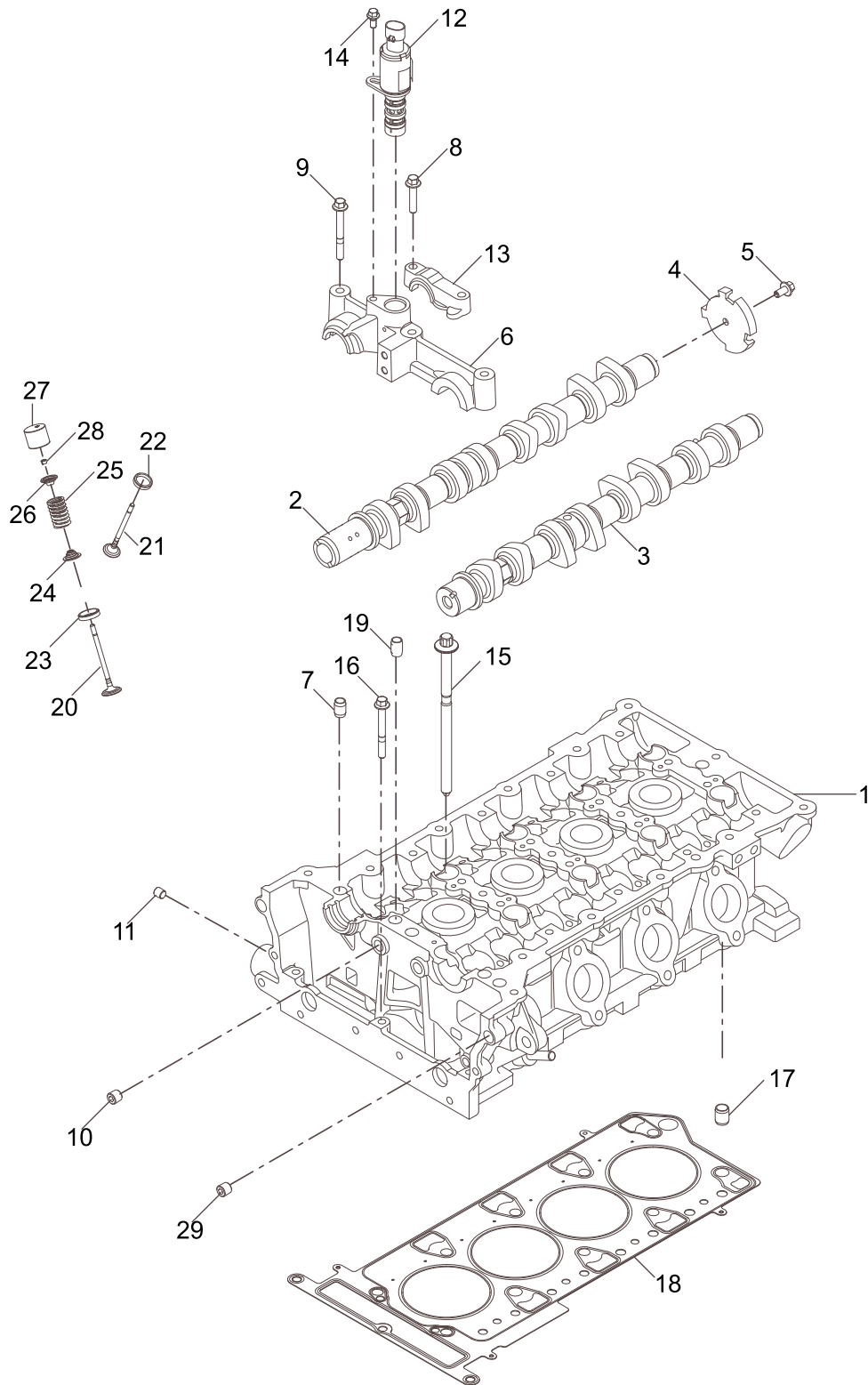


- 1. Ignition Coil
- 2. Ignition Coil Bracket
- 3. Bolt - High Tension Cord

- 4. Nut - Ignition Coil
- 5. High Tension Cord
- 6. Spark Plug

- | | |
|--------------------------------------|--|
| 7. Stud Bolt - Camshaft Cover | 12. C-Tube Clamp - Full Load Breather Tube |
| 8. Bolt - Camshaft Cover | 13. Clamp |
| 9. Seal - Oil Control Valve Body | 14. Camshaft Cover |
| 10. Oil Filler Cap | 15. Seal Ring - Camshaft Cover (Inner) |
| 11. Full Load Breather Tube Assembly | 16. Seal Ring - Camshaft Cover (Outer) |

Cylinder Head Exploded View

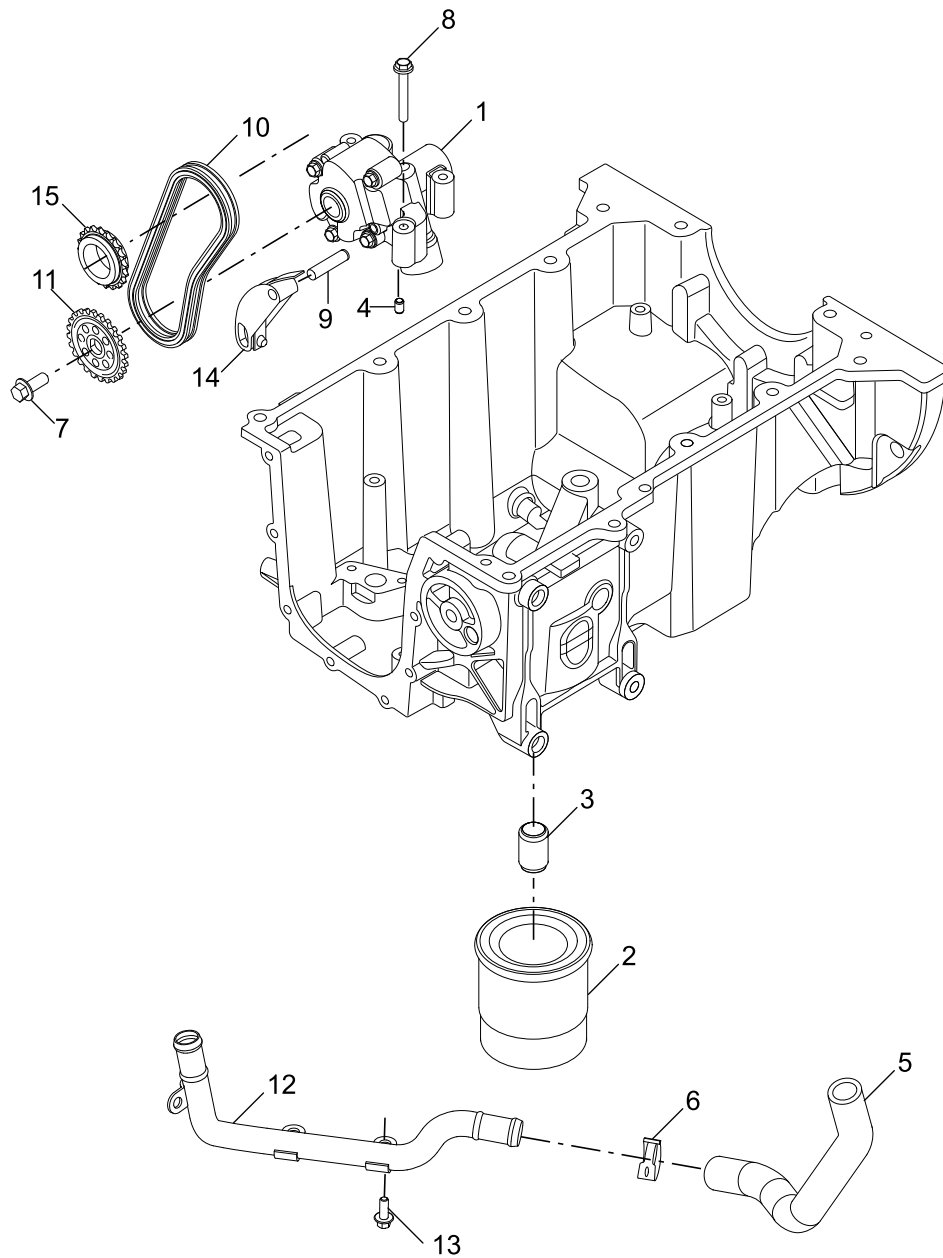


- 1. Cylinder Head
- 2. Intake Camshaft
- 3. Exhaust Camshaft

- 4. Phase Sensor Signal Plate - Camshaft
- 5. Bolt - Camshaft Signal Plate to Camshaft
- 6. Camshaft Front Bearing Cap Assembly

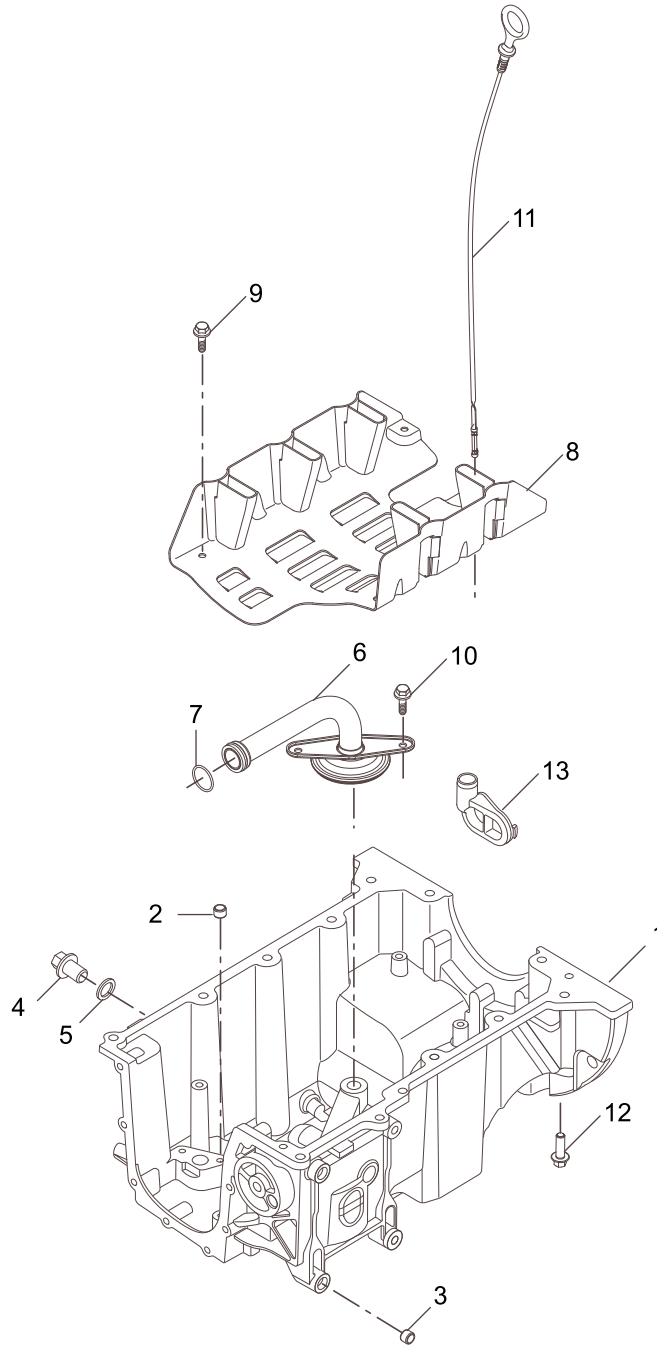
- | | |
|---|------------------------|
| 7. Location Pin - Camshaft Front Bearing Cap to Cylinder Head | 19. Check Valve |
| 8. Bolt - Camshaft Bearing Cap to Cylinder Head | 20. Intake Valve |
| 9. Bolt - Front Camshaft Bearing Cap | 21. Exhaust Valve |
| 10. Oil Passage Plug | 22. Exhaust Valve Seat |
| 11. Oil Passage Plug | 23. Intake Valve Seat |
| 12. Oil Control Valve | 24. Valve Stem Seal |
| 13. Camshaft Rear Bearing Cap | 25. Valve Spring |
| 14. Bolt - Oil Control Valve | 26. Valve Spring Seat |
| 15. Cylinder Head Bolt | 27. Tappet |
| 16. Bolt - Cylinder Head to Cylinder Block | 28. Valve Keeper |
| 17. Location Pin - Cylinder Head to Cylinder Block | 29. Oil Passage Plug |
| 18. Cylinder Head Shim | |

Oil Pump and Oil Filter Exploded View



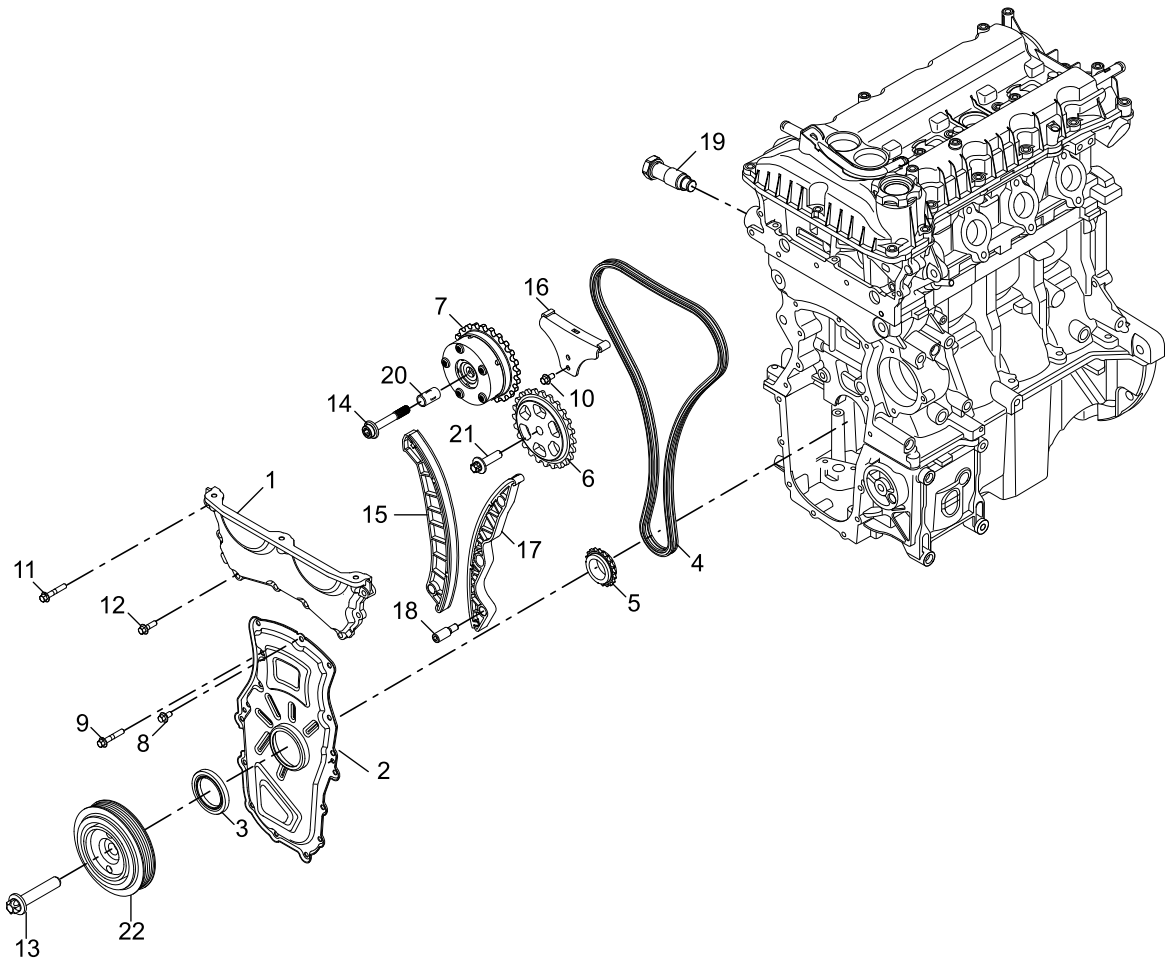
- | | |
|--|---|
| 1. Oil Pump | 9. Pin - Oil Pump Chain Tensioner |
| 2. Oil Filter | 10. Oil Pump Chain |
| 3. Oil Filter Mounting Stud | 11. Oil Pump Sprocket |
| 4. Location Pin - Oil Pump to Lower Crank Case | 12. Heater Return Pipe Assembly |
| 5. Oil Cooler Hose | 13. Bolt - Heater Return Pipe to Lower Crank Case |
| 6. Clamp - Oil Cooler Hose | 14. Oil Pump Chain Tensioner |
| 7. Bolt - Oil Pump Sprocket | 15. Crankshaft Sprocket - Oil Pump Drive |
| 8. Bolt - Oil Pump to Lower Crank Case | |

Lower Crank Case Exploded View



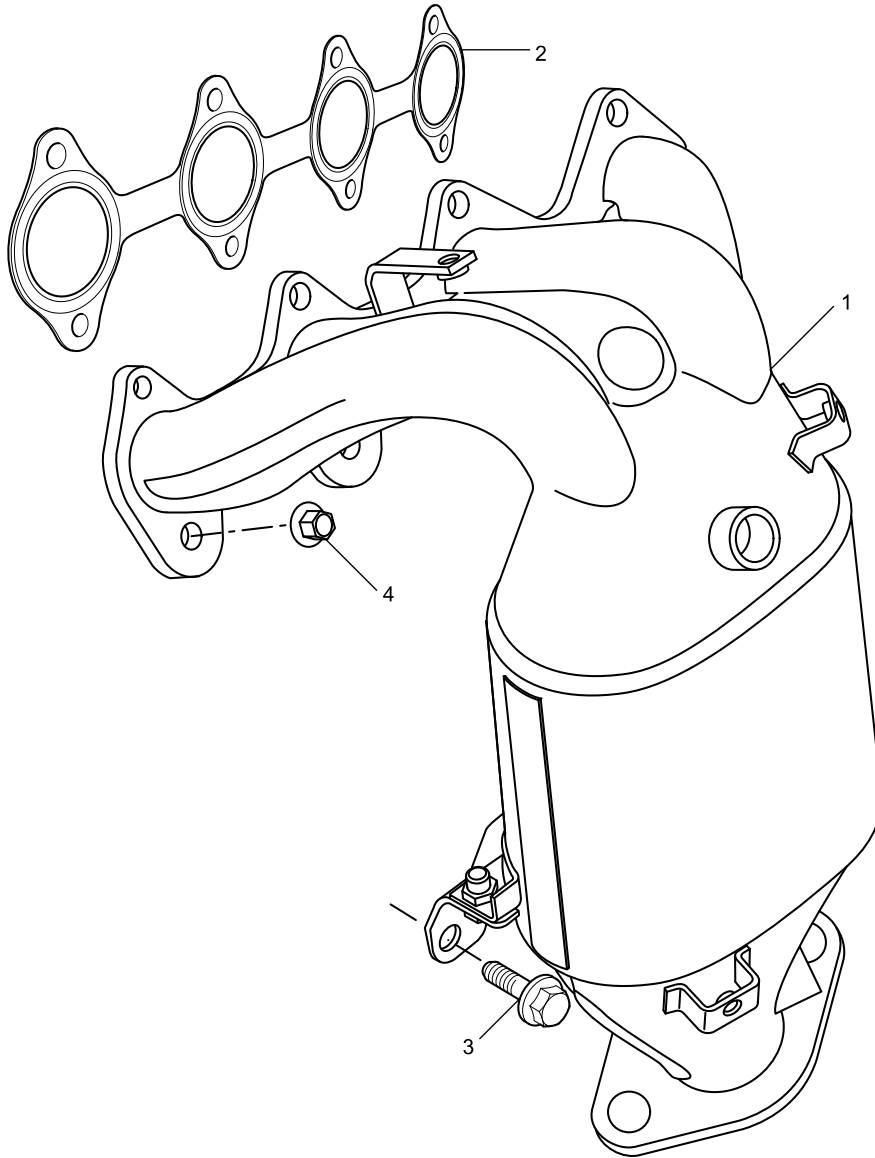
- | | |
|--|--|
| 1. Lower Crank Case | 8. Oil Baffle |
| 2. Location Pin - Lower Crank Case | 9. Bolt - Oil Baffle |
| 3. Pin Bush - A/C Compressor to Lower Crank Case | 10. Bolt - Suction Tube to Lower Crank Case Assembly |
| 4. Drain Plug | 11. Oil Dipstick |
| 5. Washer - Drain Plug | 12. Bolt - Lower Crank Case to Cylinder Block |
| 6. Suction Tube Assembly | 13. Plug |
| 7. O-ring - Suction Tube to Oil Pump | |

Timing Chain System Exploded View



- | | |
|---|---|
| 1. Upper Front Cover | 12. Bolt - Upper Front Cover to Cylinder Head |
| 2. Lower Front Cover | 13. Bolt - Crankshaft Damper |
| 3. Crankshaft Front Oil Seal | 14. Bolt - Intake Phase Modulator |
| 4. Timing Chain | 15. Tensioner Rail |
| 5. Crankshaft Sprocket - Timing Drive | 16. Upper Guide Rail |
| 6. Exhaust Camshaft Sprocket | 17. Chain Guide Rail |
| 7. Intake Phase Modulator | 18. Bolt - Chain Tensioner Pulley to Cylinder Block |
| 8. Bolt - Lower Front Cover to Cylinder Block | 19. Timing Hydraulic Tensioner |
| 9. Bolt - Lower Front Cover to Cylinder Block | 20. Oil Control Bushing |
| 10. Bolt - Sprocket Upper Guide Rail to Cylinder Head Front Bearing Cap | 21. Bolt - Camshaft Sprocket |
| 11. Bolt - Upper Front Cover to Cylinder Head | 22. Crankshaft Damper |

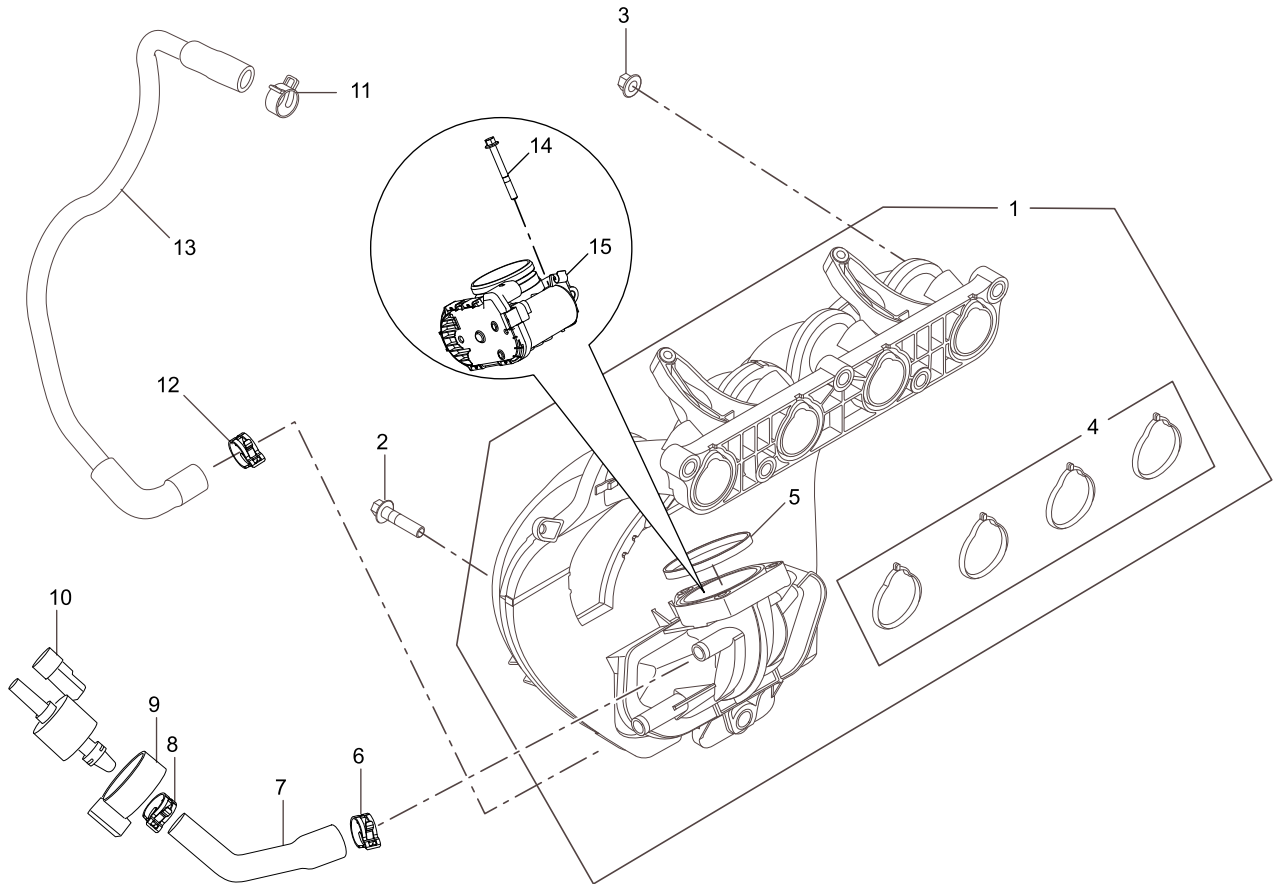
Exhaust Manifold Exploded View



- 1. Exhaust Manifold
- 2. Exhaust Manifold Gasket

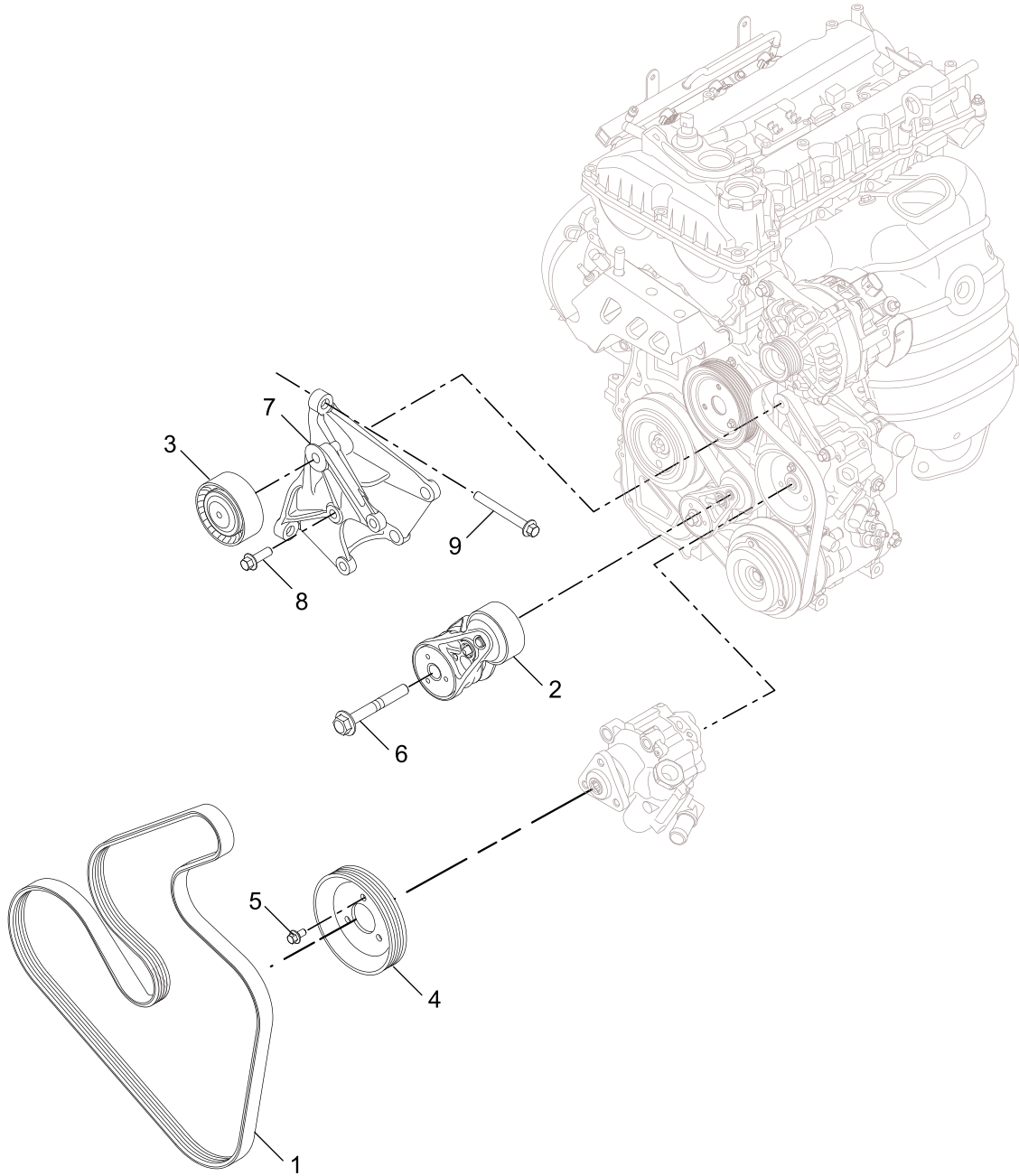
- 3. Bolt
- 4. Nut

Intake Manifold Exploded View



- | | |
|--|---|
| 1. Intake Manifold | 9. Canister Solenoid Valve Rubber Boot |
| 2. Bolt | 10. Canister Solenoid Valve |
| 3. Nut | 11. Clamp |
| 4. Intake Manifold Gasket - Cylinder Head Side | 12. Clamp |
| 5. Intake Manifold Gasket - Throttle Valve Side | 13. Partial Load Breather Tube Assembly |
| 6. Tube Clamp - Canister Solenoid Valve Connector Tube | 14. Bolt - Throttle Body |
| 7. Connector Tube - Canister Solenoid Valve to Intake Manifold | 15. Throttle Body |
| 8. Tube Clamp - Canister Solenoid Valve Connector Tube | |

Accessory Belt System

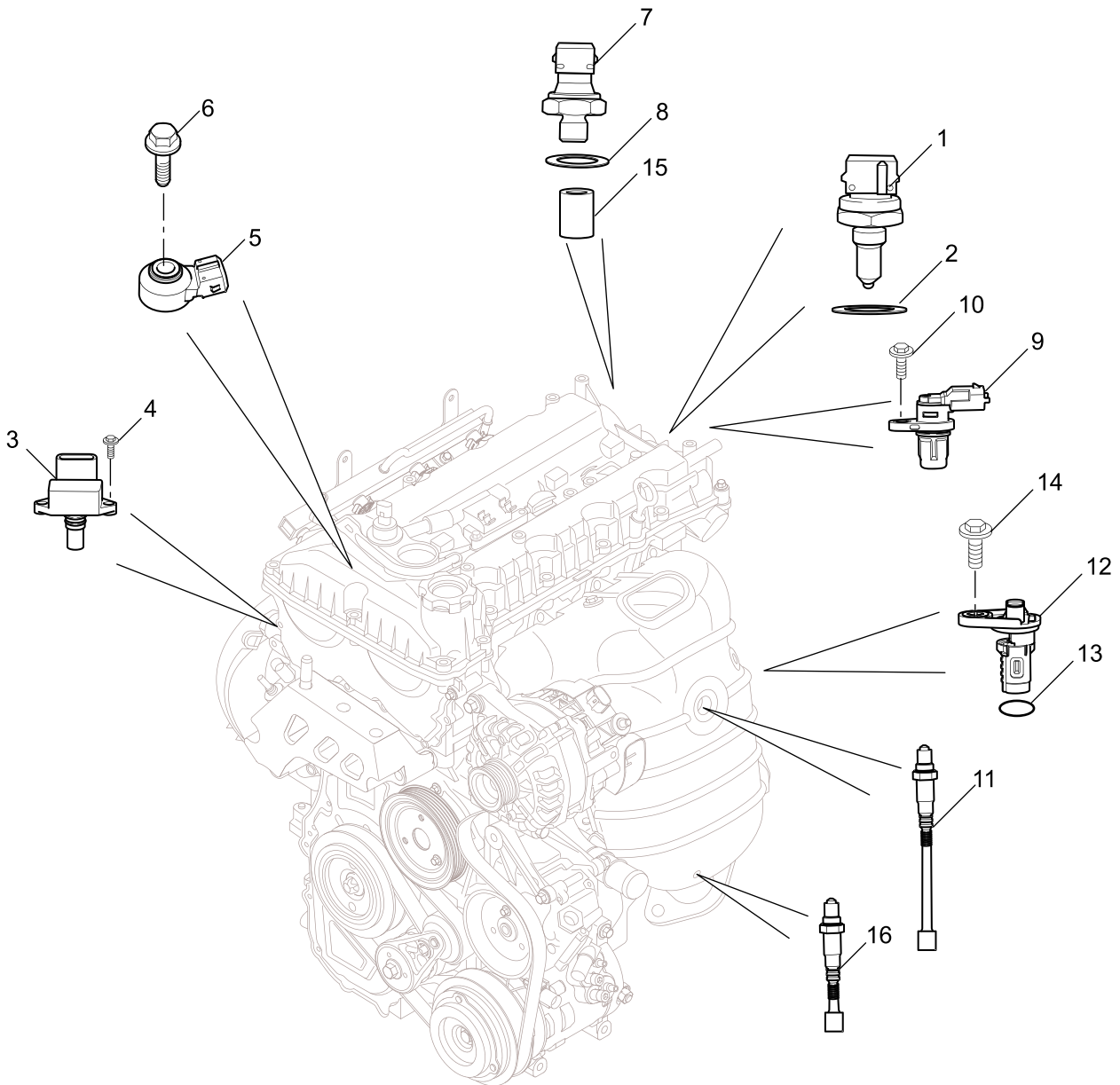


- 1. Accessory Belt
- 2. Accessory Belt Tensioner
- 3. PAS Pump Idler

- 4. Pulley - PAS Pump
- 5. Bolt - PAS Pump Pulley
- 6. Bolt - Tensioner

-
7. Bracket Assembly - PAS Pump
 8. Bolt - PAS Pump to Support Plate
 9. Bolt - PAS Pump Bracket to Cylinder Block

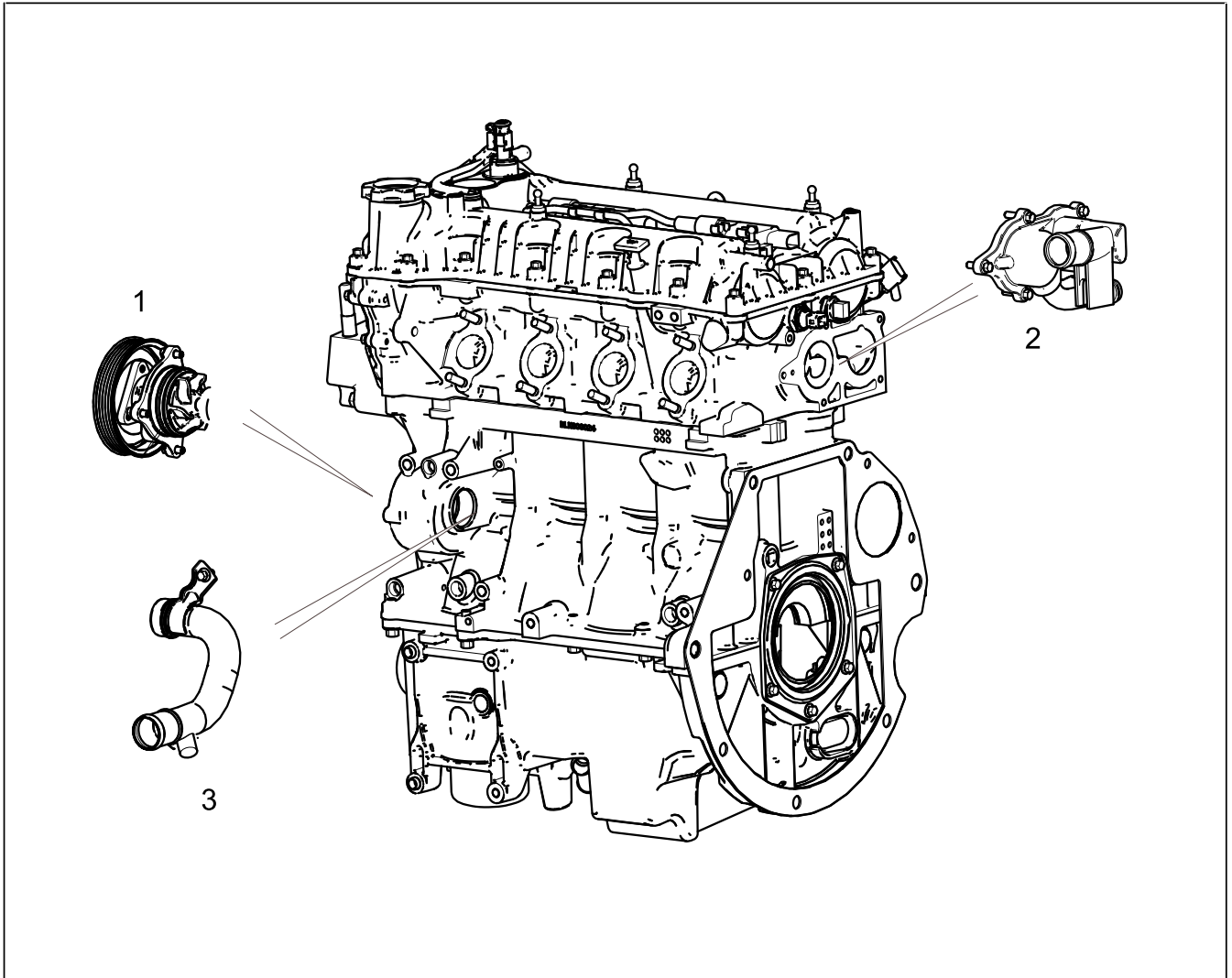
Engine Sensor



- 1. Water Temperature Sensor (Oil Temperature Sensor)
- 2. Washer - Water Temperature Sensor (Washer - Oil Temperature Sensor)
- 3. TMAP
- 4. Bolt - TMAP
- 5. Knock Sensor
- 6. Bolt - Knock Sensor
- 7. Oil Pressure Switch
- 8. Washer - Oil Pressure Switch

- 9. Cam Phase Sensor
- 10. Bolt - Phase Sensor
- 11. Front Oxygen Sensor
- 12. Crankshaft Sensor Assembly
- 13. O-ring - Crankshaft Sensor
- 14. Bolt - Crankshaft Sensor
- 15. Oil Pressure Switch Strainer
- 16. Rear Oxygen Sensor

Water Pump and Thermostat

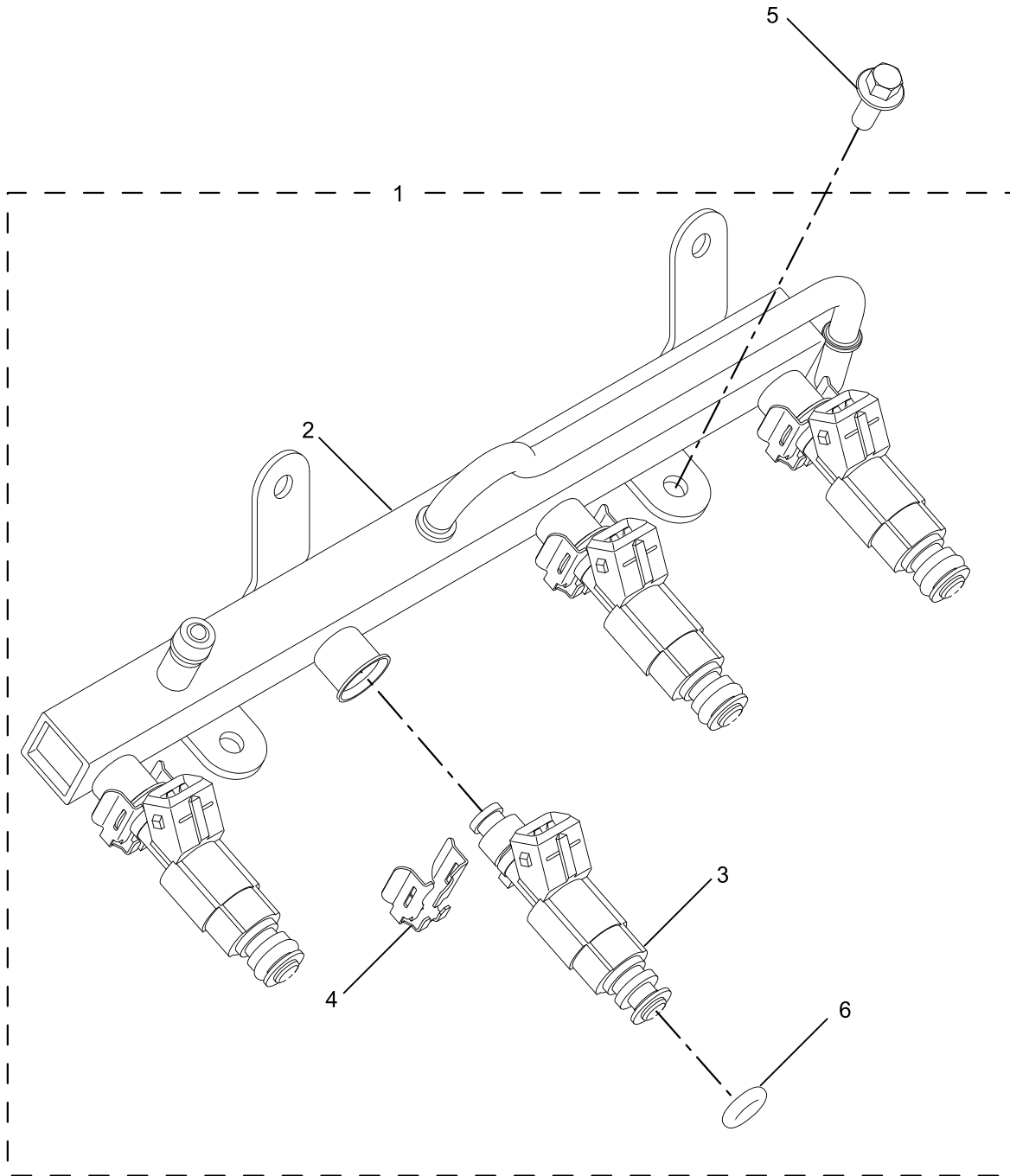


1. Water Pump

2. Thermostat Assembly

3. Water Pipe

Fuel Rail Assembly



- 1. Fuel Rail Assembly
- 2. Fuel Rail
- 3. Fuel Injector

- 4. Clamp - Fuel Injector
- 5. Bolt - Fuel Rail to Intake Manifold
- 6. O-ring - Fuel Injector

Description

General

The NSE engine has an in-line, 4-cylinder, 16-valve and double overhead camshaft structure, and timing chain drive and electronically controlled multiport fuel injection system.

It mainly consists of a cylinder block, a cylinder head, a crankshaft, connecting rods and camshafts, etc. The cylinder head, which is made of cast-aluminum material, is connected to the cast-iron cylinder block with 10 high-strength bolts through the multi-layer cylinder gasket, and another 3 high-strength bolts are directly connected to the cast-iron cylinder block, thus achieving a high-strength and reliable structure.

Cylinder Head Components

The structure of four valves for each cylinder is used for the cylinder head. The spark plug is located in the centre of the combustion chamber. Due to the use of the overhead valve mechanism, a strong swirl will be formed in the combustion chamber and mixture will be distributed evenly, which is helpful for the spread of flame and improvement of combustion, thus increasing the fuel economy, power performance and emission performance of the engine.

Mechanical tappets are mounted on the top of each valve and directly driven by the camshaft. The bosses at the bottom of the mechanical tappet are grouped by size, and the valve gap is ensured by selecting proper mechanical tappets grouped. The valve stem oil seal is press-fitted to the cylinder head oil seal retainer and it is also used as the valve spring seat to support the valve spring.

Exhaust valve is carbon deposit removing type, and the valve stem with processed sides can clean carbon deposits from the end of the valve guide and combustion chamber, so as to prevent the valves seizing up.

For the metal cylinder gasket with the multi-layer structure, the pressing ring structure is used for the cylinder bore part to strengthen the sealing, and the partial rubber coating technology is applied to ensure sealing performance.

There are four oil passages at the camshaft front bearing cap, one inlet passage, one return passage and two operating passages. Oil flows into the oil control solenoid valve through the passages. Camshaft signal plate is fitted on the end of the intake camshaft to provide signal for the camshaft position sensor. The timing pin hole on the camshaft is used to control camshaft timing phase when assembling.

The phase modulator is fitted on the drive side of the intake camshaft and secured by bolts. The main parts of the phase modulator are made by powder metallurgy. The outer casing (stator) driven by the timing chain is hydraulically connected to the inner rotor through five vanes fixed on the camshaft

end. When the engine is not running, both parts of the phase modulator are locked together by one pin under elastic load; When the engine is running, they are released hydraulically to ensure smooth starting.

An oil control valve is fitted on the front camshaft bearing cap and secured with an O-ring seal and a bolt. The control valve is a 4-way proportioning valve, including an inlet, a return port and two oil passages connected to the phase modulator operating chamber.

Cylinder Block Components

The conventional cast-iron material HT250 is used for the cylinder block, which has high overall strength and does not tend to deform. Liner is formed by honing the cylinder bore. To ensure the heat dissipation efficiency of the cylinder block, a Y-water passage is provided between two adjacent cylinders.

The semi-floating type piston pin is fitted to the thermal expansion piston made of aluminum alloy. The piston pin will deviate toward the thrust side when the engine is cold, to reduce "piston slap". And interference fit is used for the connecting rod small end. Two compression rings and one oil ring are fitted to each piston.

The connecting rod made of forged steel has an "H" section structure. The connecting rod big end moves on the bearing of the crankshaft journal. Forging and cracking technology is applied to the connecting rod.

The crankshaft has 4 balance blocks which are supported by five bearings. It controls the end float by the thrust washer on the top of the centre main bearing. The radial gap of the bearing can be selected and is controlled by the bearings of two different levels. The oil groove provided in the upper half of the main bearing supplies oil for the connecting rod big end bearing through the oil hole in the crankshaft.

Lower Crank Case Components

The lower crank case assembly consists of the lower crank case, oil pump assembly, oil strainer and oil filter.

The shape of the aluminum lower crank case is designed to be suitable for accumulating the oil around the oil strainer. The oil pump and oil strainer are integrated and then assembled to the bottom of the lower crank case. The oil passes the oil strainer with a strainer, and then the oil filter after being pressurized by the oil pump.

The oil, clean and free of impurities, is distributed to the main bearing and cylinder head through the main oil passage of the cylinder block to lubricate the parts such as the crankshaft, connecting rod, camshaft and etc. The mating surfaces of the lower crank case and cylinder block are sealed with sealant and secured with bolts. The drain bolt is located on the left side of lower crank case (in the direction of the engine front end surface).

Engine Accessory

The accessory is a single 5-ribbed belt drive system driven by the crankshaft pulley: drive the water pump, power assisted steering (PAS) pump, alternator and A/C compressor, and the belt is tensed by the damper tensioner.

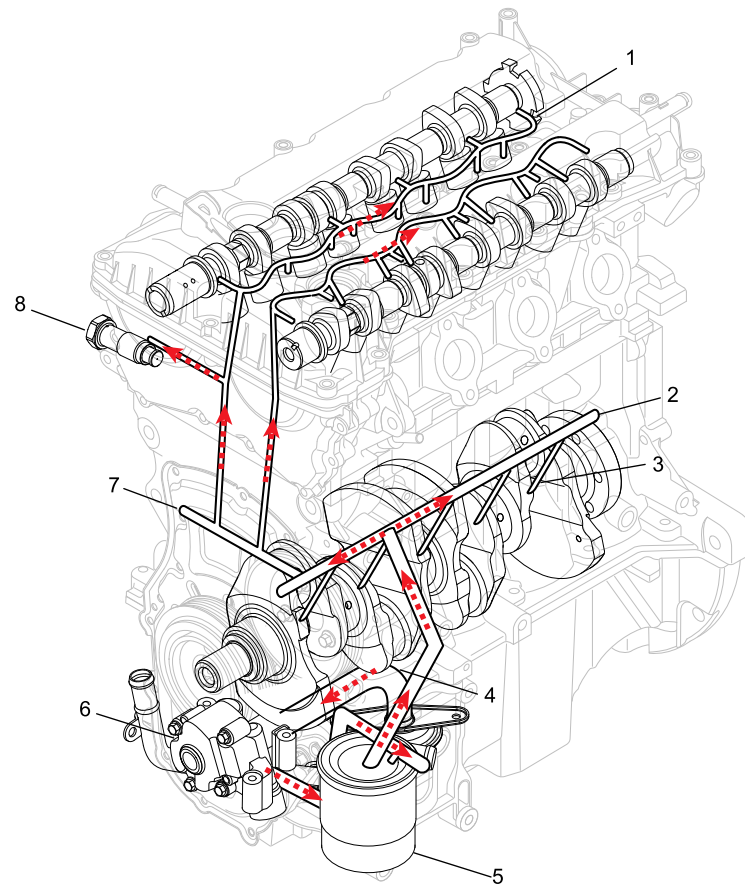
Crank Case Ventilation

The ventilation system, using the vacuum of the intake system, leads the exhaust gas blown into the crank case to the intake

system again, and then to the cylinder for combustion, thus reducing air pollution.

The oil vapour in the crank case can be separated by the oil separator in the camshaft cover, and the oil returns to the crank case.

Operation
Lubrication Circuit



- | | |
|-------------------------------------|---------------------------|
| 1. Cylinder Head Oil Passage | 5. Oil Filter |
| 2. Cylinder Block Main Oil Passage | 6. Oil Pump |
| 3. Crankshaft Crossover Oil Passage | 7. Main Oil Passage |
| 4. Oil Inlet Tube | 8. Timing Chain Tensioner |

The lubrication system is a full flow type filtering and forced oil supplying system. Oil is drawn up from the oil pan by the oil pump through the oil strainer which has a strainer to prevent foreign matter from entering the oil pump.

The oil pump with an pressure limiting valve is driven by the crankshaft through the chain. When the oil pressure reaches a certain level, the pressure limiting valve will open and the excess oil will return to the intake side of the oil pump. So the oil pressure can be maintained within a certain operating pressure range, ensuring the normal operation of the engine. The oil coming out of the oil pump outlet enters the full flow type oil filter.

The full flow type oil filter is directly fitted to the oil pan, and a bypass valve is fitted on the oil filter. When the filter element is blocked, the valve opens to keep the oil flowing smoothly. But the oil filter needs to be replaced as soon as possible.

Then, oil enters the main oil passage and directly lubricates the main bearing through the crossover circuit. The oil can be sent to the connecting rod big end bearing from the main bearing by the crossover circuit of the crankshaft.

Two side oil passages in the cylinder head are connected to the main oil passage of the cylinder block. The oil enters 2 lateral oil paths of standard length after entering the side oil passage, and it is supplied to each mechanical tappet and camshaft journal. The oil pressure switch and oil temperature sensor are fitted on the rear end of the lateral oil path to monitor oil pressure and oil temperature respectively.

The oil splashed by the crankshaft lubricates the cylinder wall. The oil collected from under the piston crown lubricates the connecting rod small end, and it enters the piston pin from the connecting rod small end through the oil path.

Service Procedures

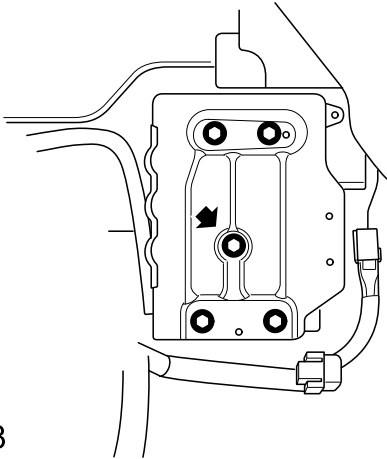
Power Assembly Removal and Refit - MT

Removal

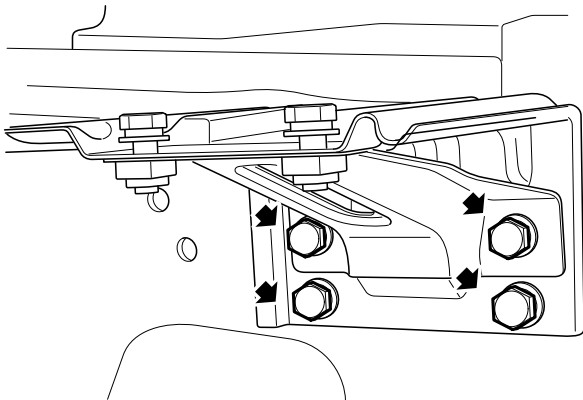
1. Hold the vehicle on the lift.
2. Disconnect the battery negative terminal.
3. Remove the battery.

Battery Box Removal

4. Remove the bolts securing the battery tray and remove the battery support.



S111N008

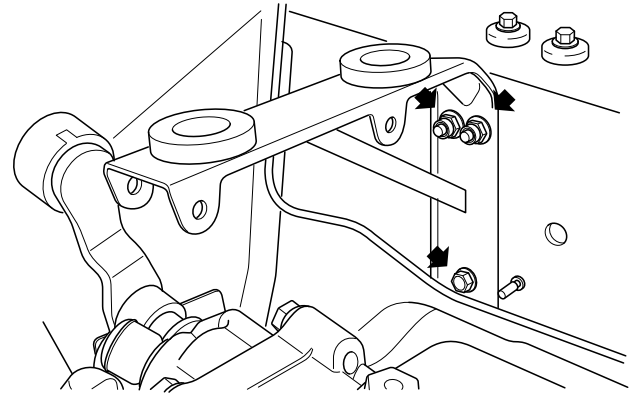


S111N009

5. Remove the air cleaner assembly.

Air Cleaner Assembly Removal

6. Remove the bolts securing the air cleaner bracket and remove the bracket.



S111N007

7. Drain the cooling system.

Drain Coolant

8. Drain the power assisted steering fluid.
9. Remove the expansion tank.

Expansion Tank Removal

10. Remove the bonnet lock body.

Bonnet Lock Body Removal

11. Remove the modular front end panel.

Modular Front End Panel Removal

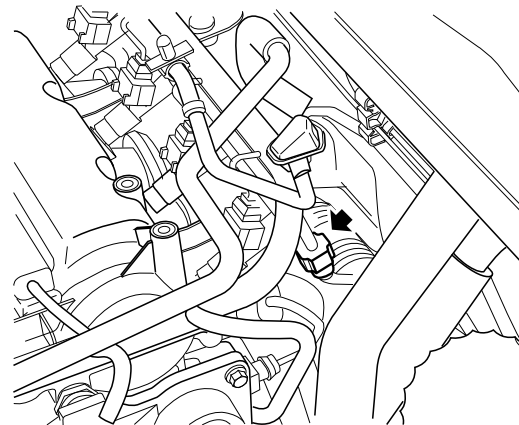
12. Remove the radiator.

Radiator Removal

13. Discharge the fuel pressure.

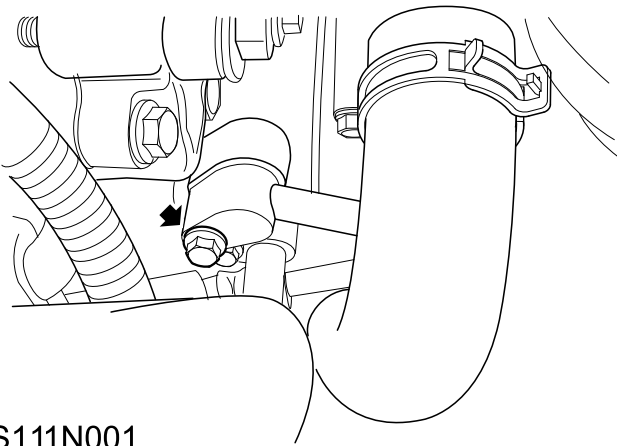
Fuel System - Discharge Pressure

14. Detach the oil supply and the return tube of the fuel rail.



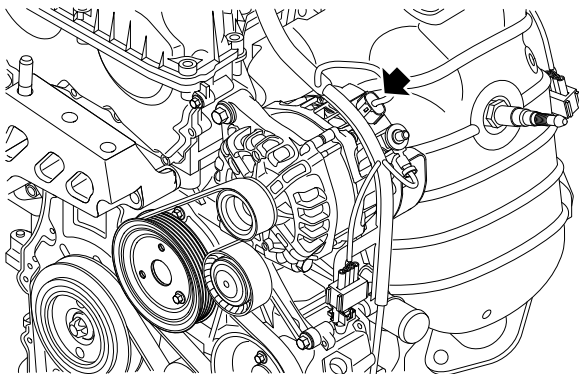
S111N002

15. Detach the A/C compressor connector and the line.



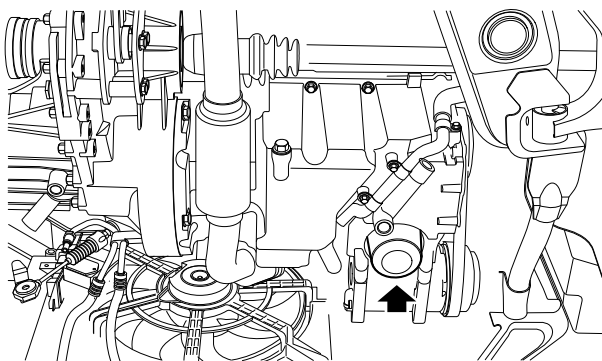
S111N001

- 16. Detach the lines and the hoses from the power assisted steering pump.
- 17. Disconnect the generator wire connector.



S841A401

- 18. Detach the engine **ECM** connector.
- 19. Remove the bolts that connect the exhaust manifold and the front exhaust pipe.



S111H405

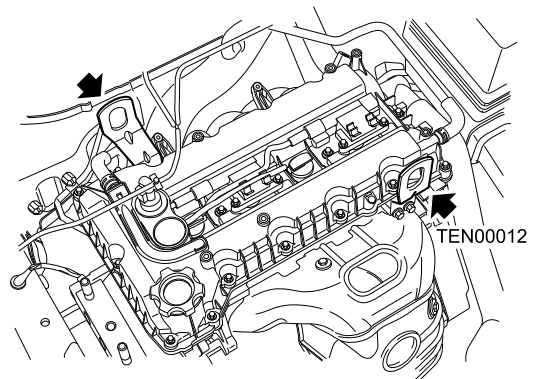
- 20. Disconnect the back-up light switch connector.
- 21. Notice the mounting position and loosen the two cable ball joints from the manual transmission gear shift rocker arm.
- 22. Loosen the snap fit, and loosen the exterior select and gear shift cable from the cable bracket.

- 23. Drain the transmission fluid.
- Manual Transmission Fluid - Drain**
- 24. Remove the drive shaft assembly.
- Drive Shaft RH Removal**
- Drive Shaft LH Removal**

- 25. Loosen the 2 nuts securing the slave cylinder to the manual transmission slave cylinder bracket, loosen and temporarily set the slave cylinder aside.

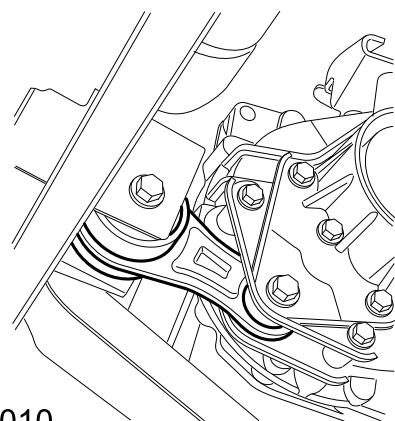
Caution: DO NOT hang the slave cylinder for a long time.

- 26. Fit the engine lifting lug special tool **TEN00012**.



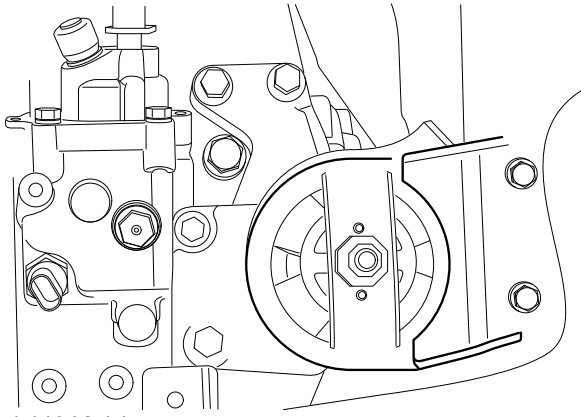
S261A401

- 27. Use the lift and connect the adjustable lift bracket **T10007** to the engine.
- 28. Use a lift to raise the weight of the engine instead of applying the load to the mounting bracket.
- 29. Remove the lower tie rod.



S111N010

- 30. Remove the power assembly mounting.
- Power Assembly Mounting Removal**
- 31. Remove the transmission case mounting.



S111N011

32. Raise the lift and remove the power assembly from the vehicle.

Refit

1. Lower the power assembly into the engine bay with help.
2. Place the unit in the mounting position.
3. Fit the transmission case mounting.
4. Fit the power assembly mounting.

 **Power Assembly Mounting Refit**

5. Fit the lower tie rod.
6. Lower the lift, disconnect the connector and remove the adjustable lift bracket **T10007**.
7. Remove the engine lifting lug special tool **TEN00012**
8. Position the slave cylinder and tighten the 2 slave cylinder set nuts to 19-25 Nm.
9. Position the gear shift lever cable on the cable bracket and secure it with snap fits.
10. Connect the gear shift cable ball joint to the gear shift rocker arm.
11. Check the transmission gear shift operation.
12. Connect the back-up light switch connector and secure the wiring harness clamp.
13. Fit the drive shaft assembly.

 **Drive Shaft Assembly RH Refit**

 **Drive Shaft Assembly LH Refit**

14. Fit the bolts connecting the exhaust manifold and front exhaust pipe.
15. Fit the engine **ECM** connector.
16. Fit the generator wire connector.
17. Connect the line and hose to the power assisted steering pump.
18. Fit the A/C compressor connector and line.
19. Fit the supply pipe line and return pipe line of the fuel rail.
20. Fit the radiator.

 **Radiator Refit**

21. Fit the expansion tank.

 **Expansion Tank Refit**

22. Fit the bonnet lock body.

 **Bonnet Lock Body Refit**

23. Fit the modular front end panel.

 **Modular Front End Panel Refit**

24. Fit the bolts securing the air cleaner bracket and tighten them to **5-7 Nm**
25. Air cleaner assembly.

 **Air Cleaner Assembly Refit**

26. Fit the bolts securing the battery tray and tighten them to 40-50 Nm.
27. Fit the battery.

 **Battery Refit**

28. Refill the cooling system.

 **Cooling System - Refill**

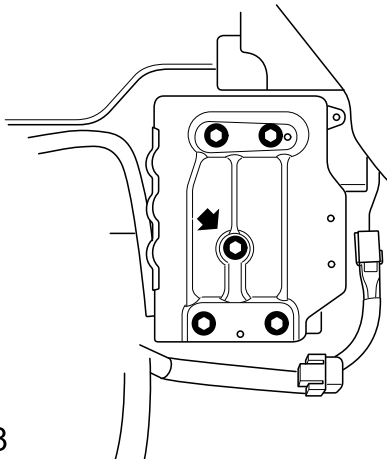
Power Assembly Removal and Refit - AT

Removal

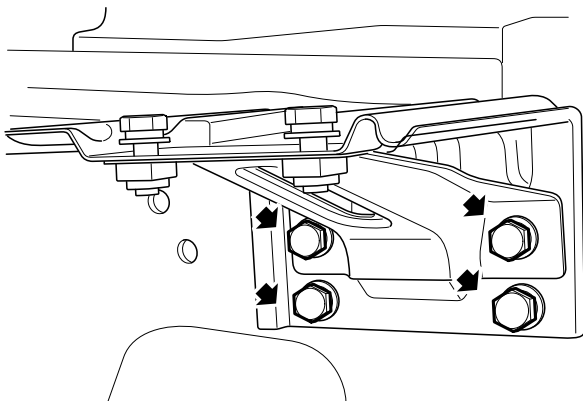
1. Hold the vehicle on the lift.
2. Disconnect the battery negative terminal.
3. Remove the battery.

Battery Box Removal

4. Remove the bolts securing the battery tray and remove the battery support.



S111N008

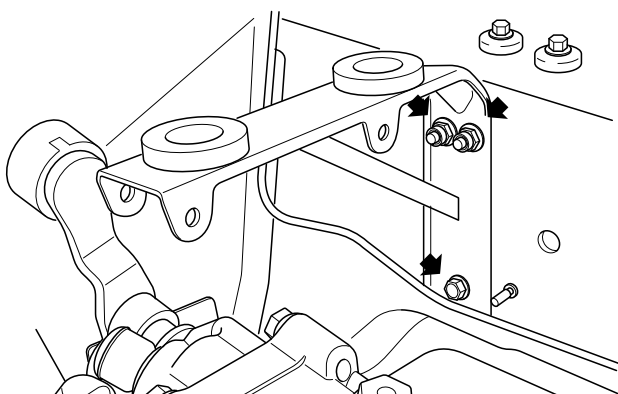


S111N009

5. Remove the air cleaner assembly.

Air Cleaner Assembly Removal

6. Remove the bolts securing the air cleaner bracket, and remove the bracket.



S111N007

7. Drain the cooling system.

Drain Cooling System

8. Drain the power assisted steering fluid.
9. Remove the expansion tank.

Expansion Tank Removal

10. Remove the bonnet lock body.

Bonnet Lock Body Removal

11. Remove the modular front end panel.

Modular Front End Panel Removal

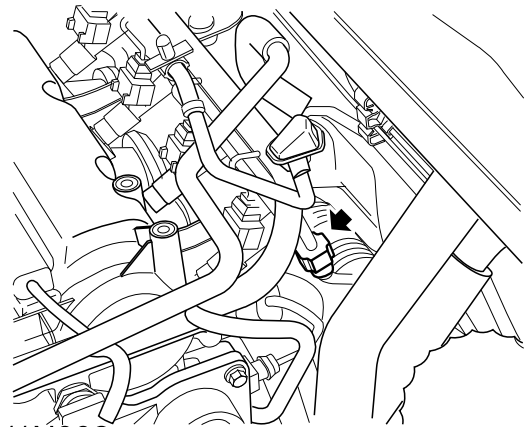
12. Remove the radiator.

Radiator Removal

13. Discharge the fuel pressure.

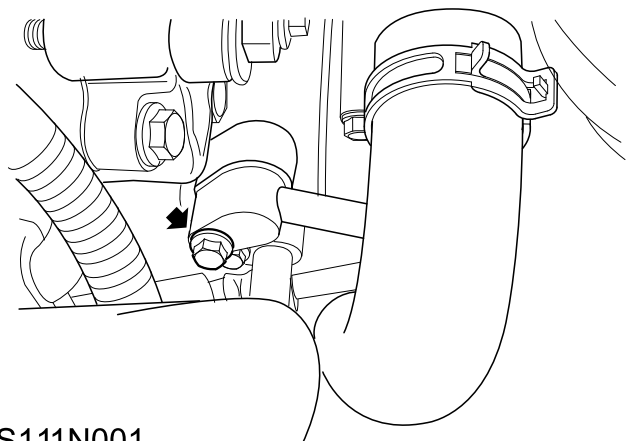
Fuel System - Pressure Discharge

14. Disengage the supply pipe line and return pipe line of the fuel rail.



S111N002

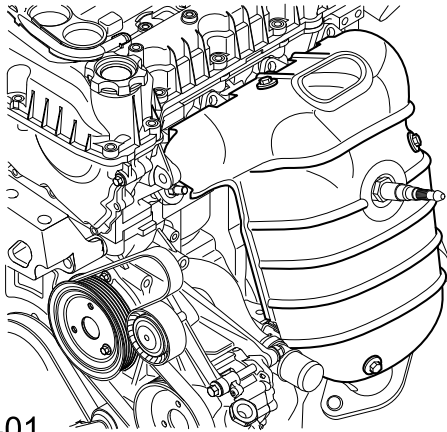
15. Disengage the A/C compressor connector and line.



S111N001

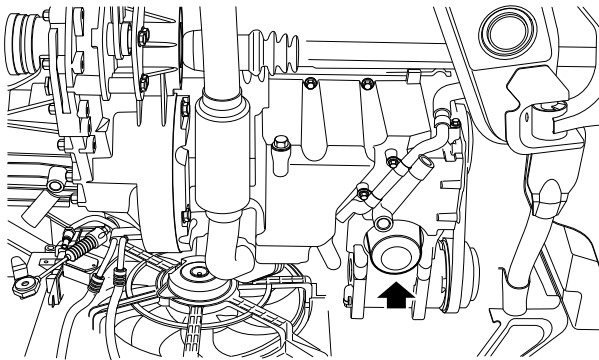
16. Disengage the line and hose from the power assisted steering pump.

17. Disconnect the generator wire connector.







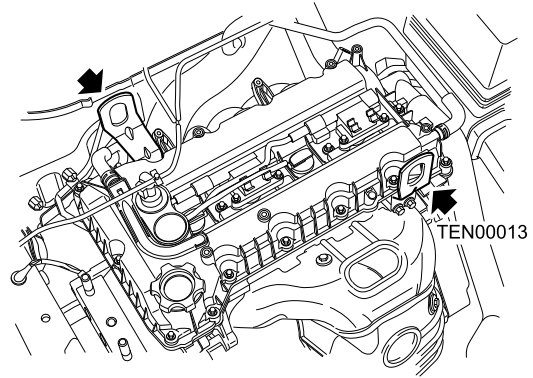
S111F401

18. Disengage the engine **ECM**.
19. Remove the bolts connecting the exhaust manifold and front exhaust pipe.



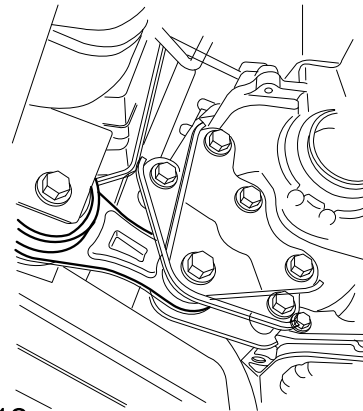
S111H405

20. Drain the automatic transmission fluid.
-  **Automatic Transmission Fluid - Drain**
21. Remove the drive shaft assembly.
-  **Drive Shaft RH**
-  **Drive Shaft LH**
22. Remove the oil cooler inlet tube and return tube.
-  **Automatic Transmission Case Oil Cooling Pipe Removal**
23. Loosen the cable on the cable bracket, and disconnect the cable from the neutral start switch.
 24. Disconnect the input speed sensor connector.
 25. Disconnect the output speed sensor connector.
- Caution: DO NOT hang the slave cylinder for a long time.**
26. Disconnect the neutral start switch connector.
 27. Disconnect the valve body wire connector.
 28. Loosen 3 snap fits securing the automatic transmission wire to the automatic transmission.
 29. Fit the engine lifting lug special tool **TEN00013**.




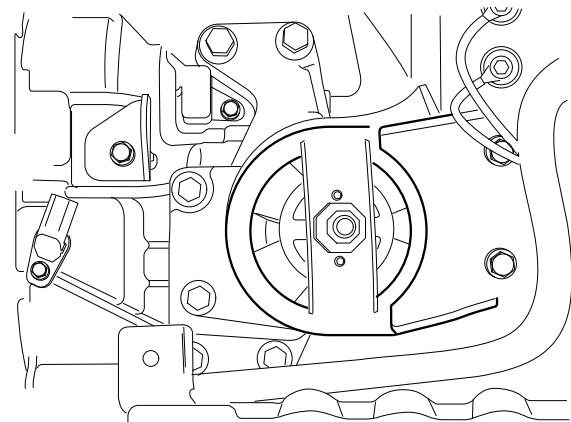
S261A401

30. Connect the adjustable lift bracket **TI0007** to the engine with the lift.
31. Use a lift to raise the weight of the engine instead of applying the load to the mounting bracket.
32. Remove the lower tie rod.



S111N012

33. Remove the power assembly mounting.
-  **Power Assembly Mounting Removal**
34. Remove the transmission case mounting.



S111N013

35. Raise the lift and remove the power assembly from the vehicle.

Refit

- I. Lower the power assembly into the engine bay with

help.

2. Place the power assembly in the mounting position.
3. Fit the transmission case mounting.
4. Fit the power assembly mounting.

 **Power Assembly Mounting Refit**

5. Fit the lower tie rod.
6. Lower the lift, disconnect the connector and remove the adjustable lift bracket **T10007**.
7. Remove the engine lifting lug special tool **TEN00012**.
8. Attach 3 snap fits securing the automatic transmission wire to the automatic transmission.
9. Fit the valve body wire connector.
10. Fit the neutral start switch connector.
11. Fit the output speed sensor connector.
12. Fit the input speed sensor connector.
13. Fit the cable on the cable bracket and connect the cable to the neutral start switch.
14. Fit the oil cooler inlet tube and return tube.

 **Refit of Automatic Transmission Case Oil**

Cooling Pipe

15. Fit the drive shaft assembly.

 **Drive Shaft Assembly RH Refit**

 **Drive Shaft Assembly LH Refit**

16. Automatic transmission fluid.

 **Automatic Transmission Fluid – Refill**

17. Fit the bolts connecting the exhaust manifold and front exhaust pipe.
18. Fit the engine **ECM** connector.
19. Fit the generator wire connector.
20. Connect the line and hose to the power assisted steering pump.
21. Fit the A/C compressor connector and line.
22. Fit the supply pipe line and return pipe line of the fuel rail.
23. Remove the radiator.

 **Radiator Refit**

24. Fit the expansion tank.

 **Expansion Tank Refit**

25. Fit the bonnet lock body.

 **Bonnet Lock Body Refit**

26. Fit the modular front end panel.

 **Modular Front End Panel Refit**

27. Fit the bolts securing the air cleaner bracket and tighten them to **5-7 Nm**.

28. Air cleaner assembly.


 **Air Cleaner Assembly**

29. Fit the bolts securing the battery tray and tighten them to **40-50 Nm**.

30. Fit the battery.

 **Battery Refit**

31. Fit the cooling system.

 **Cooling System Refill**

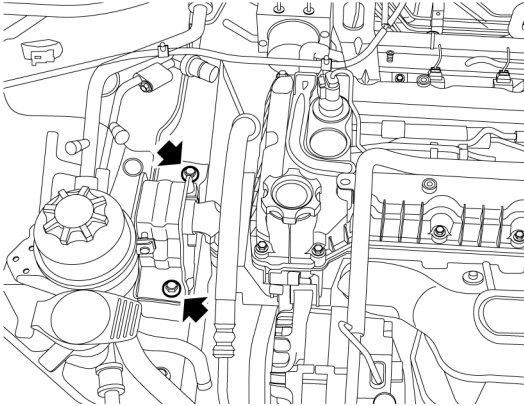
Power Assembly Mounting

Removal

1. Disconnect the battery negative terminal.
2. Support the engine with a jack.

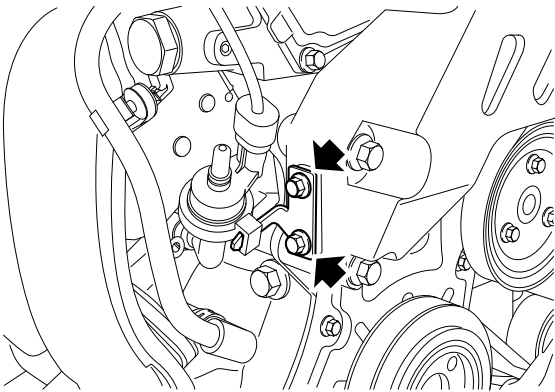
Caution: To prevent damage to components, place a wood board or hard rubber at the bottom of the jack.

3. Remove the bracket connecting the vehicle and engine mounting RH.



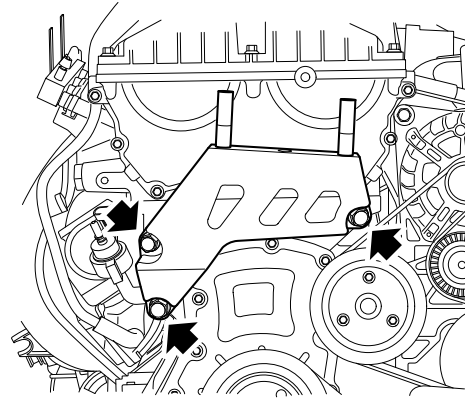
S261A402

4. Remove the wire bracket and other items fitted on the engine mounting.



S261A403

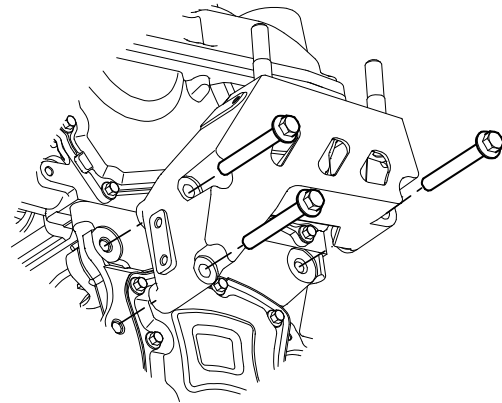
5. Unscrew the 3 bolts securing the engine mounting RH to the cylinder block.



S261A404

Refit

1. Clean the engine mounting and mounting surfaces of the engine mounting and cylinder block.
2. Fit the engine mounting to the engine with engine mounting bolts, and the tightening torque for fitting is **40-50 Nm**



S261A405

3. Connect the battery ground.

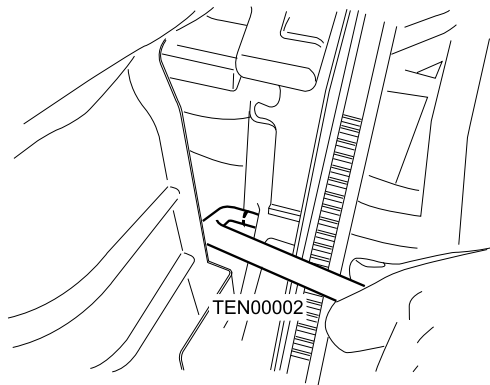
Flywheel MT

Removal

1. Remove the clutch assembly.

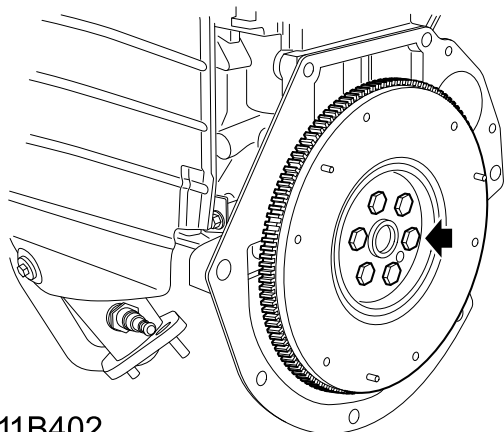
 **Clutch Assembly Removal**

2. Remove the plug from the timing hole of the cylinder block.
3. Turn the flywheel until the flywheel pin hole is aligned with the pin hole of the cylinder block.
4. Insert the flywheel timing pin special tool **TEN00002** into the flywheel pin hole through the timing hole of the cylinder block to lock the flywheel.



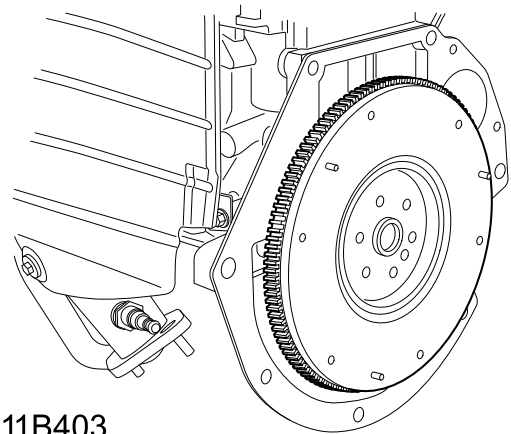
S111B401

5. Unscrew and dispose of the 6 bolts securing the flywheel to the crankshaft.



S111B402

6. Remove the flywheel from the crankshaft.

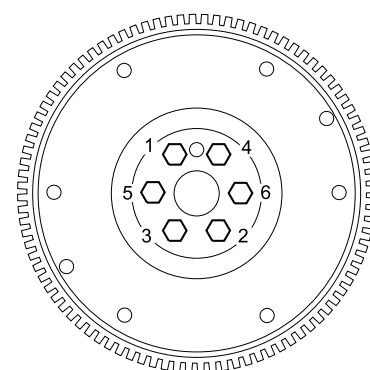


S111B403

7. Remove the flywheel timing pin special tool **TEN00002**.

Refit

1. Saw two gullets on the bolt used in the flywheel with an angle of 45 degrees between the gullet and bolt shank, and then clean the bolt holes on the crankshaft in order with the bolt.
2. Clean the mating surfaces of the flywheel and crankshaft.
3. Fit the flywheel to the crankshaft.
4. Fit new bolts coated with sealant and tighten them firmly by hand.
5. Insert the flywheel timing pin special tool **TEN00002** into the timing hole of the cylinder block to lock up the flywheel.
6. In diagonal order, tighten the bolts to **(32–38)Nm + 60°**



S111B404

7. Remove the flywheel timing pin special tool **TEN00002**.
8. Fit the plug.
9. Fit the clutch assembly.

 **Clutch Assembly Refit**

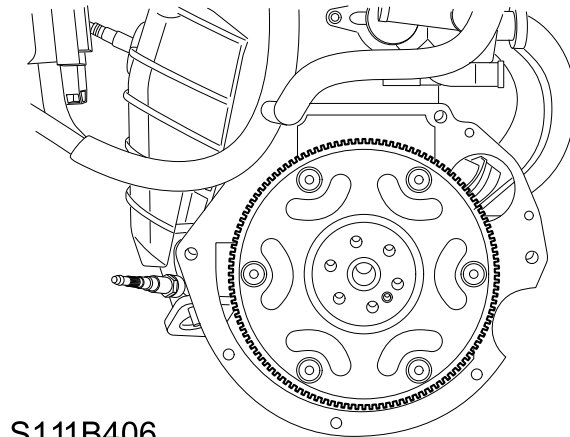
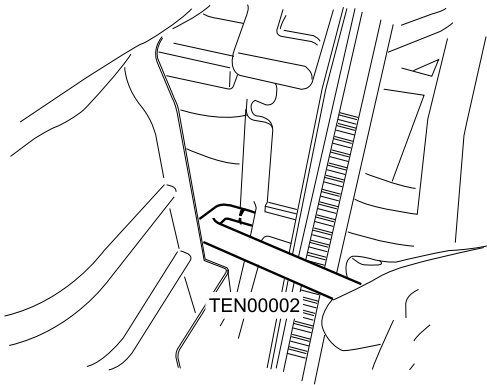
Torque Converter Drive Plate AT

Removal

1. Remove the automatic transmission.

Automatic Transmission Removal

2. Remove the plug from the timing hole of the cylinder block.
3. Turn the drive plate to align the drive plate pin hole with the pin hole of the cylinder block.
4. Insert the flywheel timing pin special tool **TEN00002** into the drive plate pin hole through the cylinder block timing hole to lock the drive plate.



S111B406

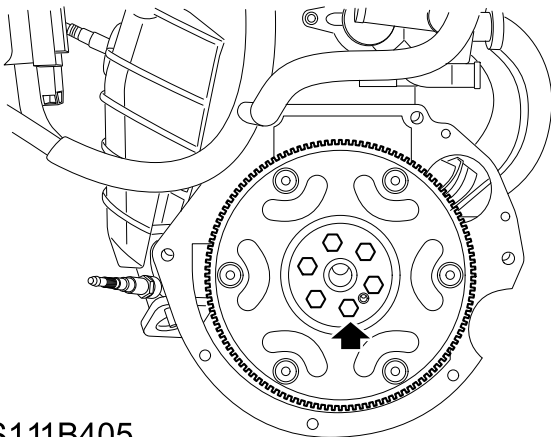
7. Remove the flywheel timing pin special tool **TEN00002**.

Refit

1. Saw two gullets on the bolt used in the drive plate with an angle of 45 degrees between the gullet and bolt shank, and then clean the bolt holes on the crankshaft in order with the bolt.
2. Clean the mating surfaces of the drive plate and crankshaft.
3. Fit the drive plate to the crankshaft.
4. Fit new bolts coated with sealant and DO NOT tighten them firmly.
5. Insert the flywheel timing pin special tool **TEN00002** into the timing hole of the cylinder block to lock up the drive plate.
6. In diagonal order, tighten the bolts to **(32–38)Nm + 60°**

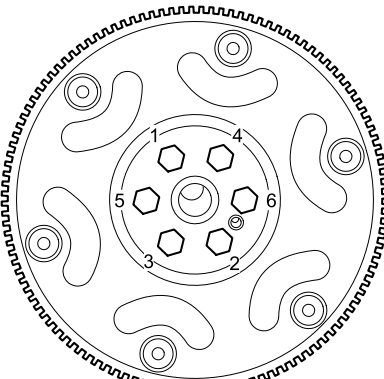
S111B401

5. Unscrew and dispose of 6 bolts securing the flywheel to the crankshaft and the 6 bolts securing the drive plate to the crankshaft.



S111B405

6. Remove the drive plate from the crankshaft.



S111B407

7. Remove the drive plate timing pin special tool **TEN00002**.
8. Fit the plug.
9. Fit the automatic transmission.

Automatic Transmission Refit

Crankshaft Pulley

Removal

1. Disconnect the battery ground.
2. Raise the front part of the vehicle.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

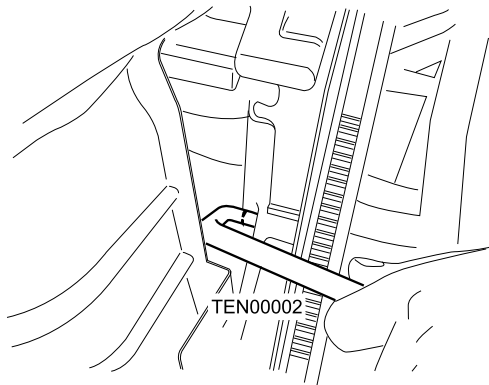
3. Remove the front right wheel.
4. Remove the ignition coil.

 **Ignition Coil Removal**

5. Remove the camshaft cover.

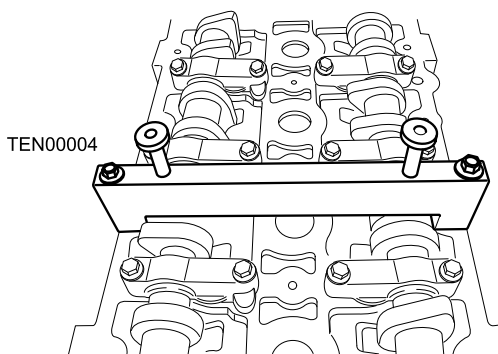
 **Camshaft Cover Removal**

6. Remove the plug fitted into the timing pin hole on the cylinder block.
7. Turn the flywheel until the flywheel pin hole is aligned with the cylinder block pin hole.



S111B401

8. Insert the timing pin special tool **TEN00002** into the cylinder block timing pin hole and the flywheel pin hole, to lock up the flywheel.
9. Use the camshaft lock special tool **TEN00004** to lock the camshaft phase.



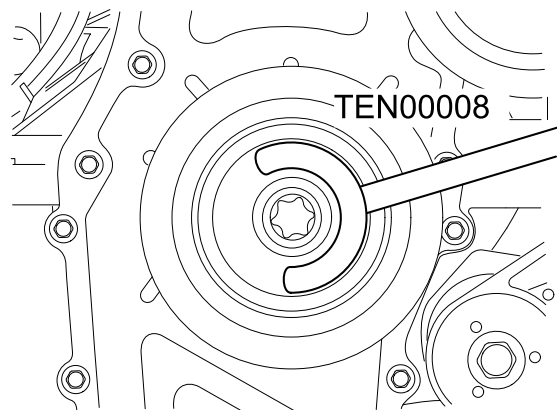
S111B408

10. Remove the accessory drive belt.

 **Accessory Drive Belt Removal**

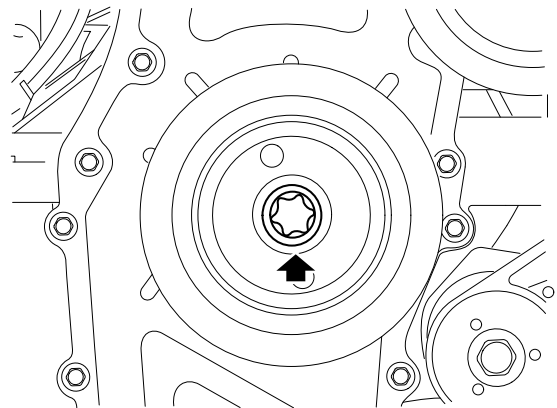
11. Using the crankshaft pulley holding special

tool **TEN00008** hold the crankshaft pulley.



S111A414

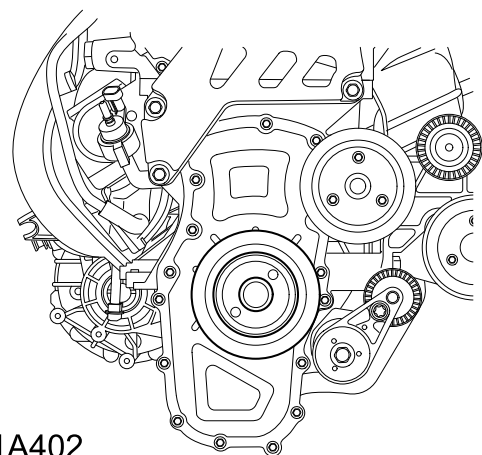
12. Loosen and remove the bolt from the pulley to the crankshaft, and dispose of it.



S111A401

13. Remove the crankshaft pulley.

Caution: Avoid damaging the crankshaft front oil seal lip when removing the pulley.



S111A402

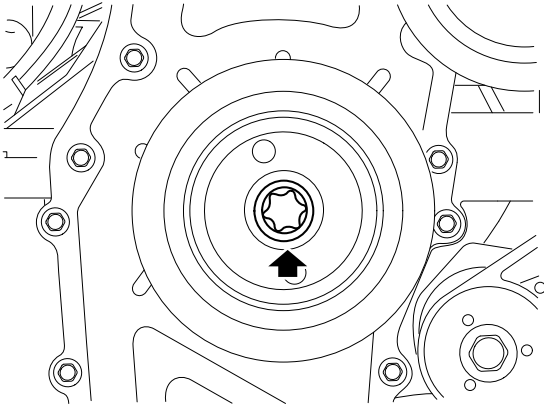
Refit

1. Clean the mating surfaces of the crankshaft pulley and the crankshaft front oil seal.

Caution: If it is necessary to replace the crankshaft front oil seal, try to keep the centre axis of the pulley align with the centre axis of the crankshaft without deflection to

avoid damaging the seal lip during pushing the crankshaft pulley with hand.

2. Fit the crankshaft pulley, using the crankshaft pulley holding special tool **TEN00008** hold the crankshaft pulley, then tighten the bolts and the torque is **60 Nm + 120°**.



S111A401

3. Fit the accessory drive belt.

Accessory Drive Belt Refit

4. Remove the camshaft phase lock special tool **TEN00004**.
5. Remove the flywheel timing pin special tool **TEN00002**.
6. Fit the plug.
7. Fit the camshaft cover.

Camshaft Cover Refit

8. Fit the ignition coil.

Ignition Coil Refit

9. Fit the front right wheel.
10. Lower the vehicle.
11. Connect the battery ground.

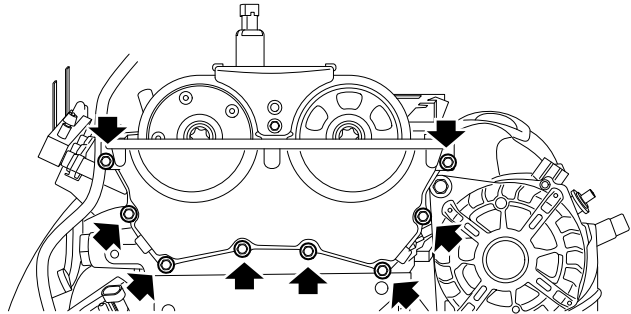
Timing Chain Upper Cover Plate

Removal

1. Remove the camshaft cover.

Camshaft Cover Removal

2. Loosen the 8 bolts securing the timing chain upper cover plate.

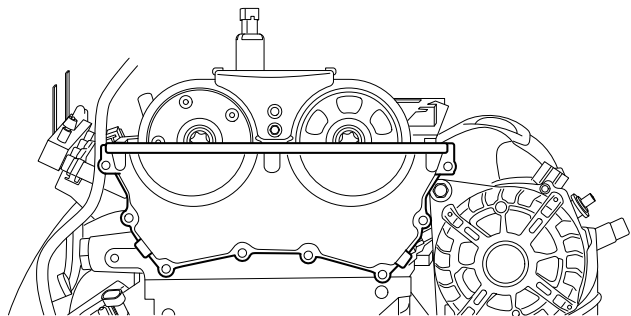


S111J401

3. Remove the bolts securing the timing chain upper cover plate, and there are 8 set bolts in total.

Caution: When removing the timing chain upper cover plate, ensure that the cover plate does not deform.

4. Remove the timing chain upper cover plate.



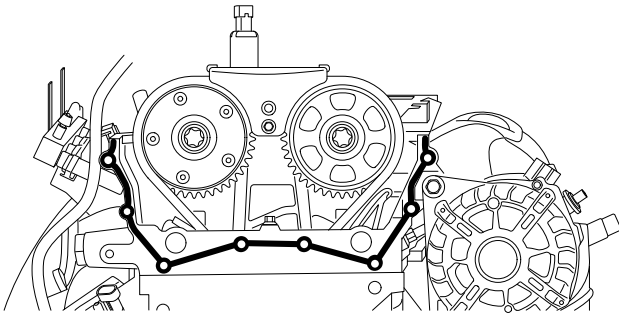
S111J402

Refit

1. Check the timing chain upper cover plate.

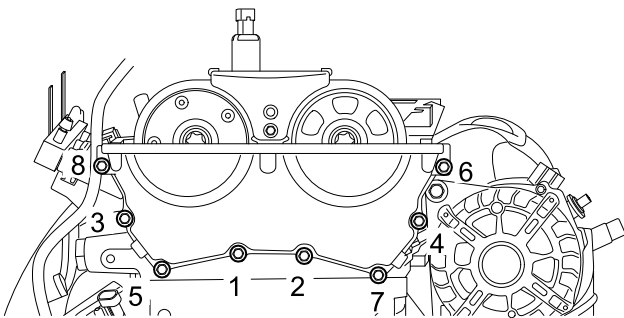
Caution: Ensure that there is no damage on the timing chain upper cover plate, otherwise, it may cause oil leak.

2. Apply adhesive to the mating surfaces of the timing chain upper cover plate and the cylinder head along the seal area (1.5-2.0 mm wide).



S111J403

3. Fit the bolts securing the timing chain upper cover plate, and tighten them to **8-12 Nm**, and there are 8 set bolts in total.



S111J426

4. Fit the camshaft cover.

 **Camshaft Cover Refit**

Timing Chain Lower Cover Plate Removal

Warning: Always replace both crankshaft front oil seal and timing chain lower cover plate together.

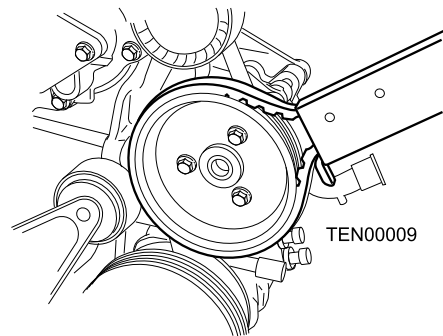
1. Disconnect the battery negative terminal.
2. Remove the accessory drive belt.

 **Accessory Drive Belt Removal**

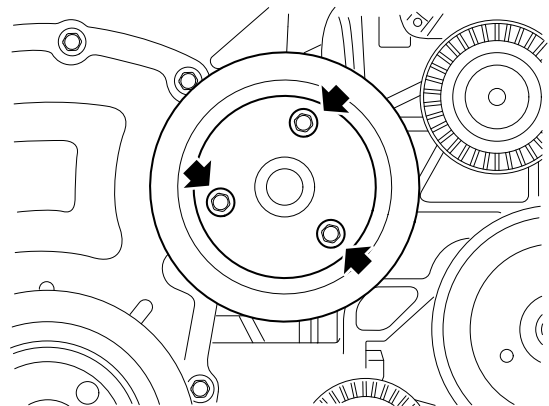
3. Remove the crankshaft pulley.

 **Crankshaft Pulley Removal**

4. Using the pulley replacer special tool **TEN00009** to remove the water pump pulley.

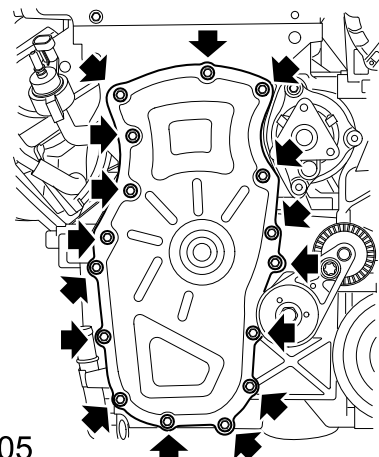


S111J423



S111J404

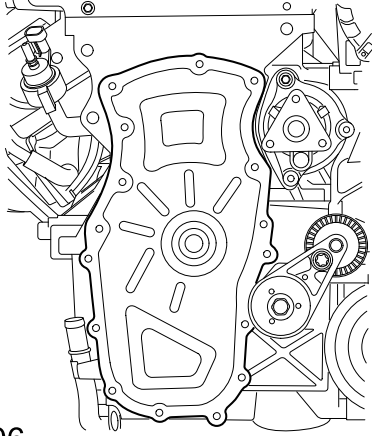
5. Remove the bolts securing the timing chain lower cover plate.



S111J405

- Remove the timing chain lower cover plate, and then dispose of the crankshaft front oil seal and the timing chain lower cover plate.

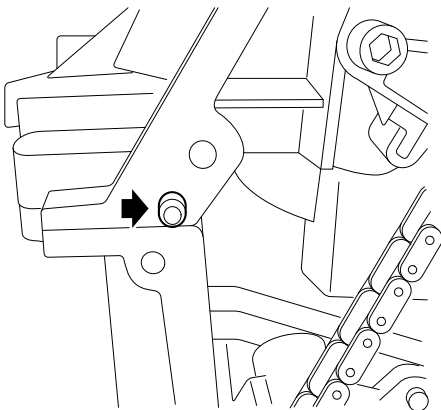
Caution: Be sure to keep the flatness of the timing chain lower cover plate when removing it, otherwise, it will cause oil leak.



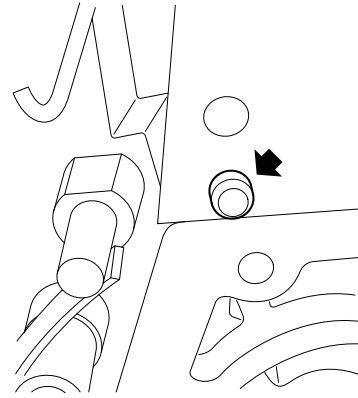
S111J406

Refit

- Remove the adhesive on the contact surfaces of the cylinder body and the timing chain lower cover plate, and ensure that there is no adhesive remaining on the cylinder block.
- Clean the crankshaft pulley journal.
- Fit the timing chain lower cover plate pin (if not removed, then refit is unnecessary).

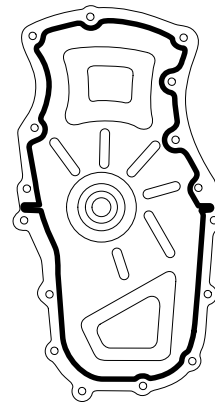


S111J407



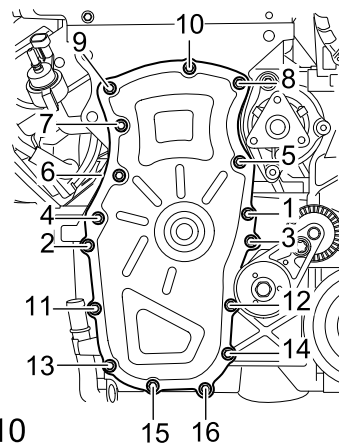
S111J408

- Apply adhesive with a width of about 2.5 mm as shown in the illustration above by using the appropriate tool, be sure to keep the adhesive continuous.



S111J409

- Fit the timing chain lower cover plate assembly bolts, tighten them in the order of 1 to 16 as shown in the illustration below to the torque **8-12 Nm**, and finish the fitting in 3 - 5 minutes.

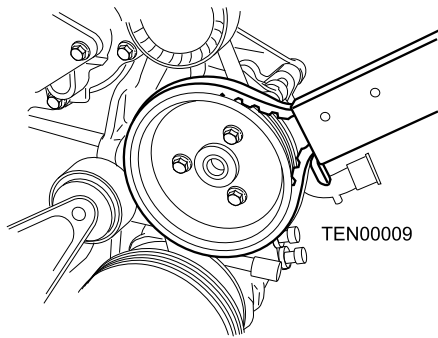


S111J410

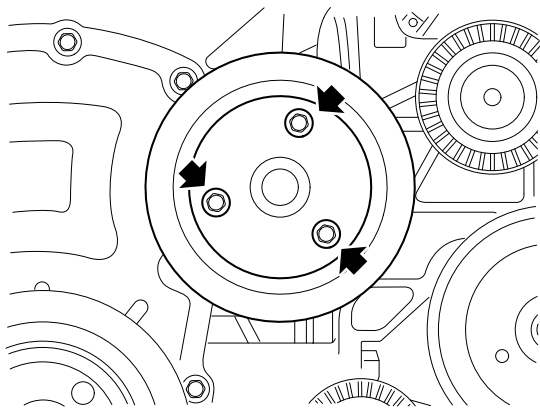
- Fit the crankshaft pulley.

Hand icon Crankshaft Pulley Refit

- Using the pulley replacer special tool TEN00009, fit the water pump pulley.



S111J423



S111J404

8. Fit the accessory drive belt.

 **Accessory Drive Belt Refit**

9. Connect the battery ground.

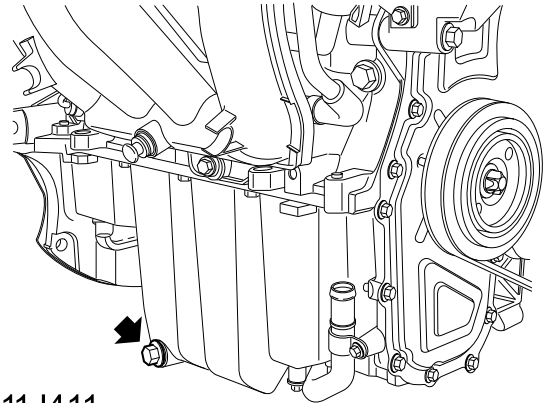
Timing Chain

Removal

1. Raise the front part of the vehicle.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

2. Loosen the drain bolt to drain the oil.



S111J411

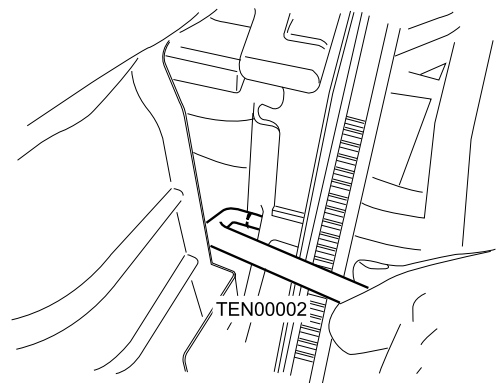
3. Remove the front right wheel.
4. Remove the ignition coil.

 **Ignition Coil Removal**

5. Remove the camshaft cover.

 **Camshaft Cover Removal**

6. Remove the plug fitted into the timing pin hole on the cylinder block.
7. Turn the flywheel until the flywheel pin hole is aligned with the cylinder block pin hole.
8. Insert the timing pin lock special tool **TEN00002** into the cylinder block timing pin hole and the flywheel pin hole, to lock up the flywheel.



S111B401

9. Use the camshaft lock special tool **TEN00004** to lock the camshaft phase.
10. Remove the accessory drive belt.

 **Accessory Drive Belt Removal**

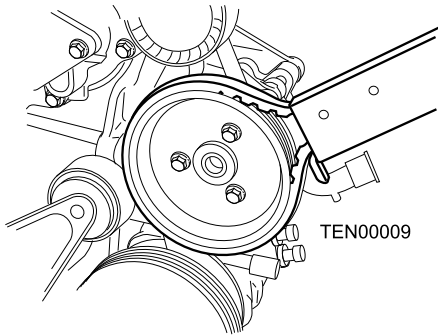
11. Loosen and remove the bolt from the crankshaft pulley

to the crankshaft, and dispose of it.

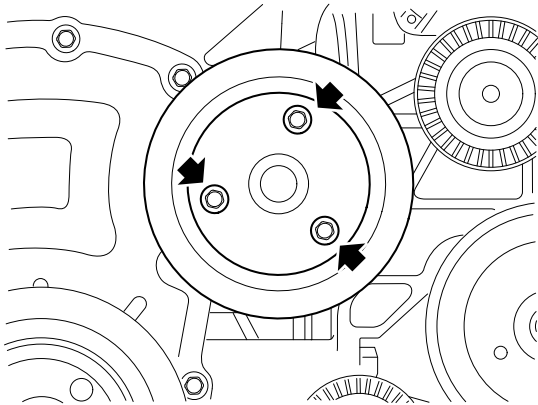
12. Remove the crankshaft pulley.

 **Crankshaft Pulley Removal**

13. Using the pulley replacer special tool **TEN00009**, remove the water pump pulley.



S111J423



S111J404

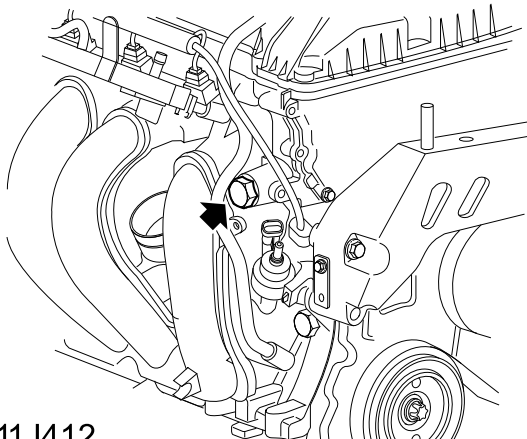
14. Remove the timing chain upper cover plate.

 **Timing Chain Upper Cover Plate Removal**

15. Remove the timing chain lower cover plate.

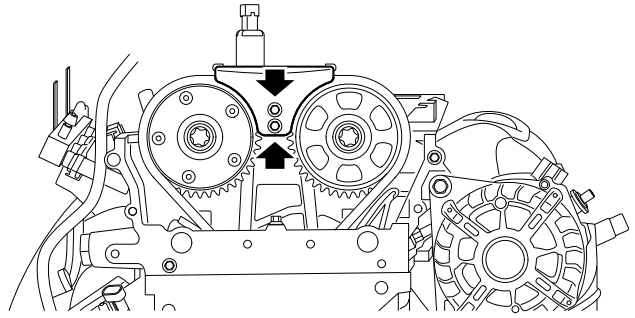
 **Timing Chain Lower Cover Plate Removal**

16. Remove the timing chain tensioner, and dispose of the seal washer.



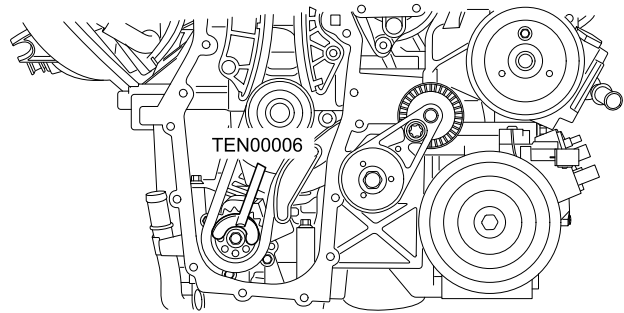
S111J412

17. Remove the upper rail.



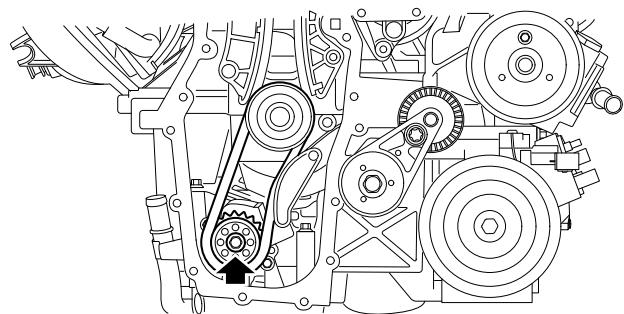
S111J413

18. Using the oil pump sprocket holding special tool **TEN00006**, remove the oil pump sprocket bolts.

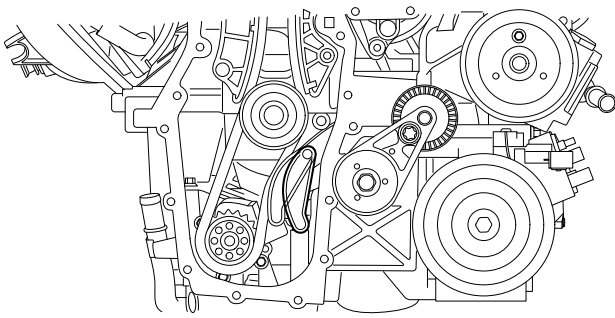


S111J424

19. Detach the oil pump chain tensioner to the right, and remove the oil pump sprocket together with the oil pump chain and the crankshaft sprocket driving the oil pump.

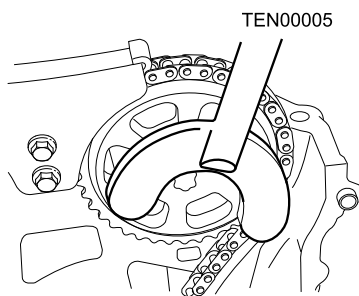


S111J414



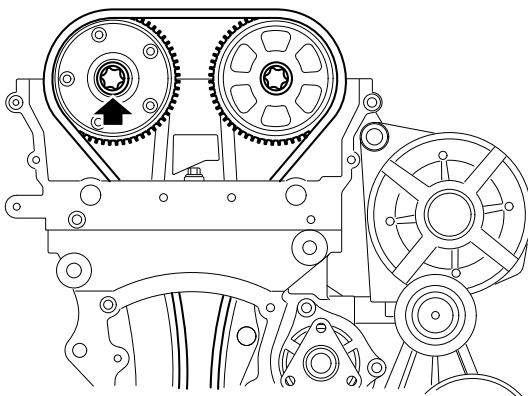
S111J415

20. Remove the oil pump chain tensioner.
21. Remove the intake phase modulator bolts, and dispose of them.
22. Using the camshaft sprocket holding special tool **TEN00005** remove the exhaust camshaft sprocket bolts, and dispose of them.



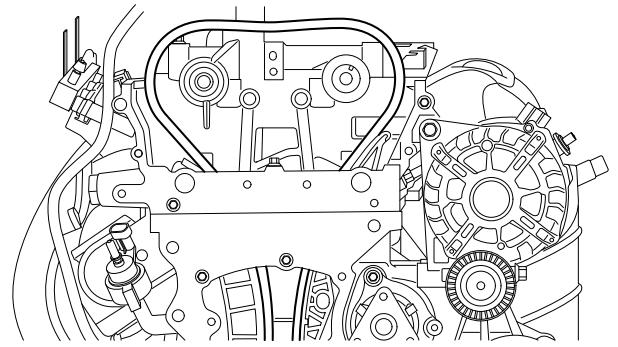
S111J425

23. Remove the intake phase modulator and the exhaust camshaft sprocket.



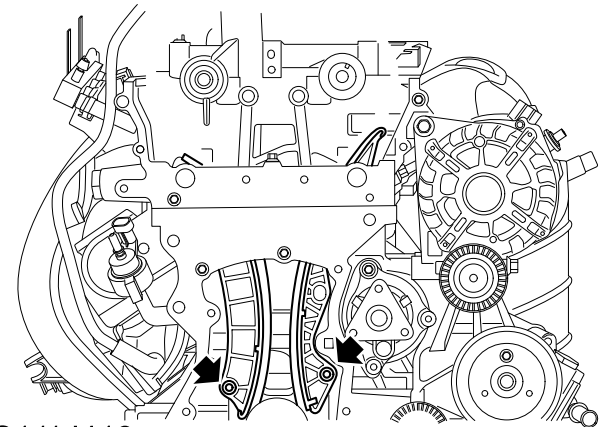
S111J416

24. Remove the crankshaft sprocket - timing drive and the timing chain.



S111J417

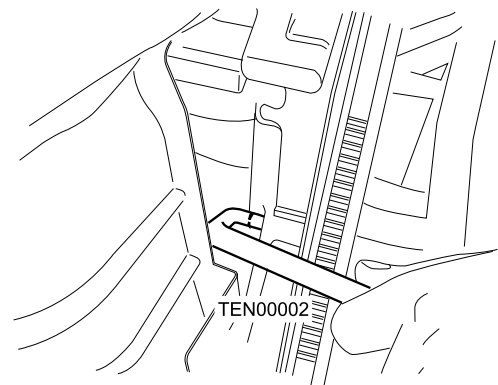
25. Remove the guide rail pivot pins and remove the tensioner rail and the chain guide rail from the upper end of the chain case.



S111J418

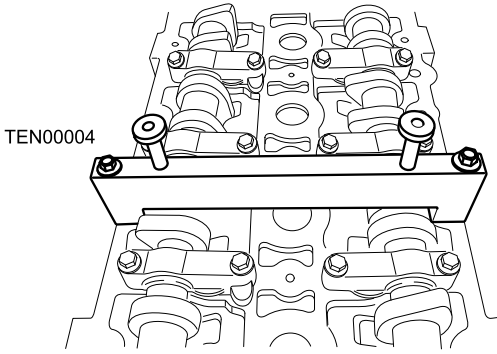
Refit

1. Remove the plug fitted into the timing pin hole on the cylinder block.
2. Turn the flywheel until the flywheel pin hole is aligned with the cylinder block pin hole.
3. Insert the flywheel lock special tool **TEN00002** into the cylinder block timing pin hole and the flywheel pin hole, to lock up the flywheel.



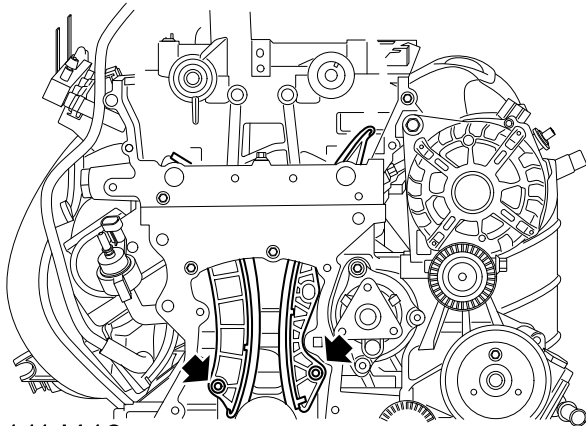
S111B401

4. Use the camshaft lock special tool **TEN00004** to lock the camshaft phase.



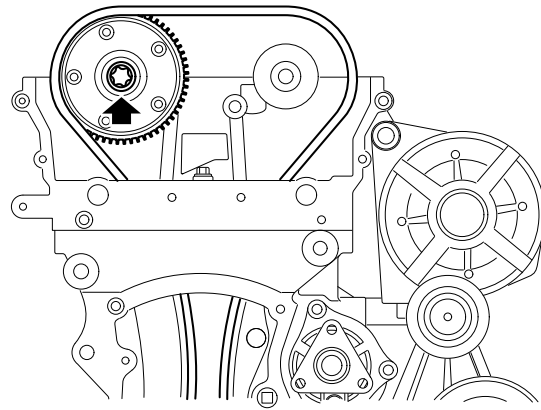
S111B408

5. Check each part for any damage, oil, rust and dirt before assembly. If there is any damage, DO NOT use it. If there is any oil, be sure to wipe it off.
6. Set the chain guide rail in from the upper right side of the guide rail box, screw each pivot pin, finally tighten the pivot pins in order to the torque **22-28 Nm**.
7. Set the tensioner guide rail in from the upper left side of the guide rail box, screw the pivot pins, finally tighten the pivot pins to the torque **22-28 Nm**.



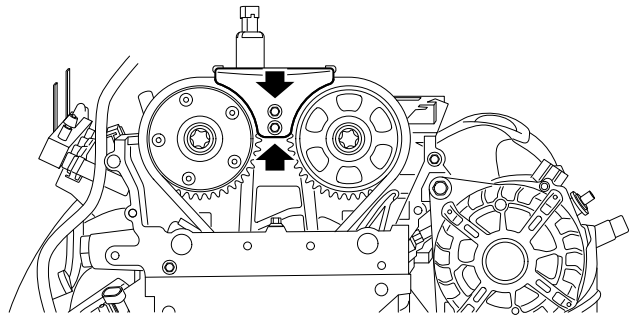
S111J418

8. Set a crankshaft sprocket - timing drive into the front of the crankshaft. Place the timing chain in from the top of the cylinder head guide rail box, set the lower part of the chain onto the crankshaft sprocket, and hang the chain on the upper rail mounting boss. Fit the intake phase modulator to the intake camshaft and pretighten the bolts.
9. After fitting the camshaft sprocket to the exhaust camshaft with the camshaft sprocket holding special tool **TEN00005** and pretightening the bolts, fit the chain onto the two sprockets.



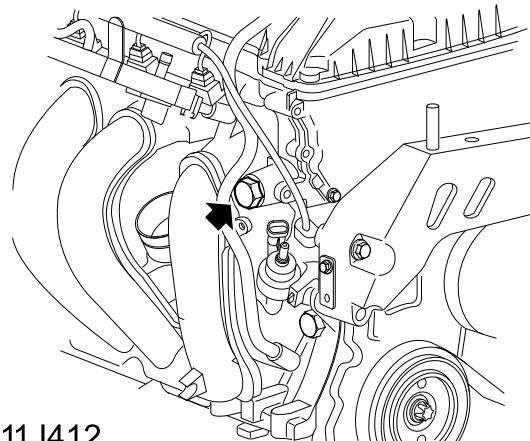
S111J419

10. Fit the upper guide rail on the camshaft front bearing cap, secure it with two bolts, and tighten them to the torque **8-12 Nm**.



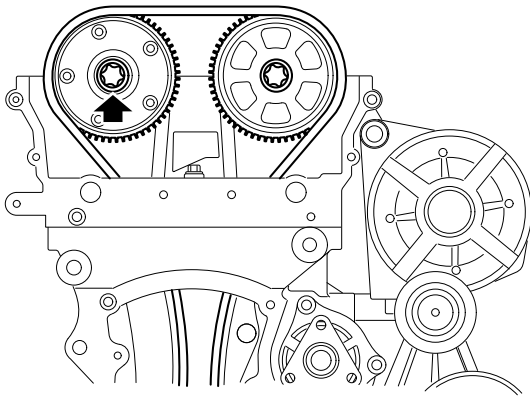
S111J413

11. After replacing the timing hydraulic tensioner washer with a new one, screw the timing hydraulic tensioner onto the cylinder head, and tighten it to the torque **57-63 Nm**.



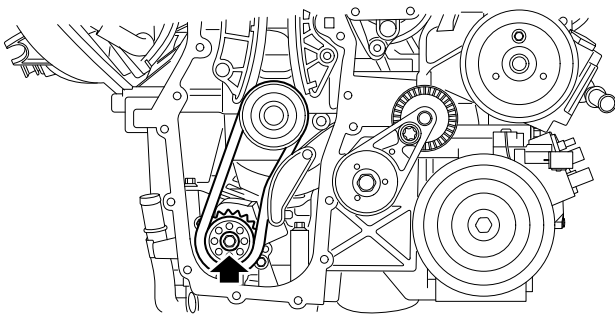
S111J412

12. Tighten the intake phase modulator and the exhaust camshaft sprocket onto the camshaft, fasten the exhaust camshaft sprocket bolt to the torque **25 Nm + 45°**, and the intake phase modulator bolts to **70-80 Nm**.



S111J416

13. Fit the oil pump chain tensioner.



S111J414

14. Set the oil pump chain onto the crankshaft sprocket - oil pump drive, and then slide the crankshaft sprocket - oil pump drive into the front of the crankshaft.

Caution: At the foot of the crankshaft sprocket-oil pump teeth side is a dent mark that is used to distinguish it with the crankshaft sprocket-timing chain.

15. Set the oil pump sprocket into the oil pump chain.

Tip: The side with product logo faces outward.

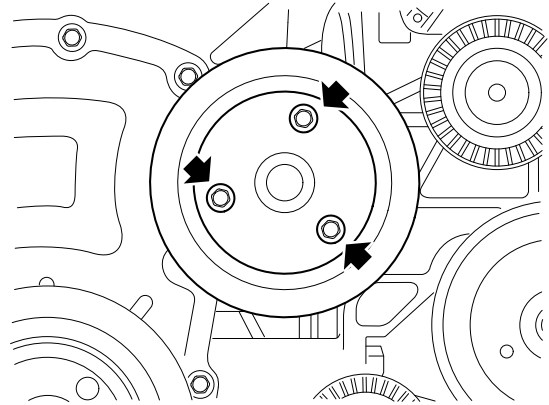
16. Rotate the oil pump sprocket, to align the D-hole in its centre with the D-shaft of the oil pump.
17. Pull the lower part of the oil pump chain tensioner to the right, set the oil pump sprocket onto the oil pump shaft, and firmly push the crankshaft sprocket into the end.
18. Release the oil pump chain tensioner.
19. Check whether the oil pump chain is correctly pressed on the guide surface of the tensioner.
20. Using the special tool **TEN00006**, set the oil pump sprocket, screw the oil pump sprocket bolts, finally tighten them to the torque **22-28 Nm**.
21. Fit the timing chain lower cover plate.

 **Timing Chain Lower Cover Plate Refit**

22. Fit the timing chain lower cover plate.

 **Timing Chain Upper Cover Plate Refit**

23. Fit the water pump pulley.




S111J404

24. Fit the crankshaft pulley.

 **Crankshaft Pulley Refit**

25. Fit the accessory drive belt.

 **Accessory Drive Belt Refit**

26. Remove the camshaft phase lock tools.
27. Remove the flywheel timing pin special tool **TEN00002**.
28. Fit the plug.
29. Fit the camshaft cover.

 **Camshaft Cover Refit**

30. Fit the ignition coil.

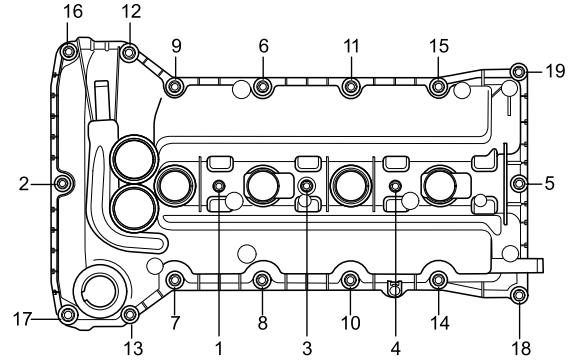
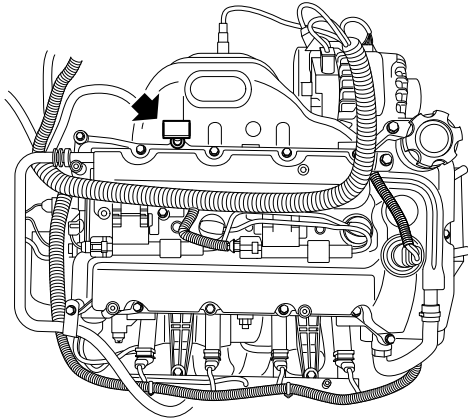
 **Ignition Coil Refit**

31. Fit the wheel.
32. Lower the vehicle.
33. Inspect the oil level, and add oil if necessary.

Camshaft Cover

Removal

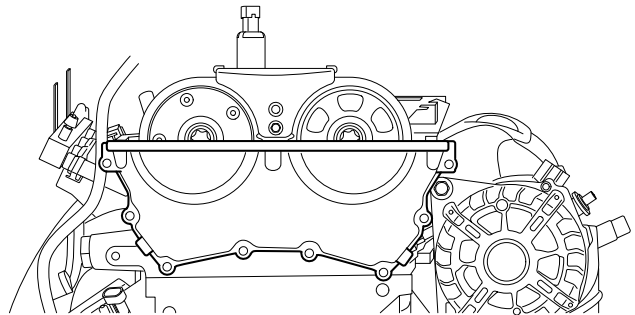
1. Remove the oil dipstick.



7. Remove the camshaft cover, be careful to protect the check valve diaphragms and keep them clean.

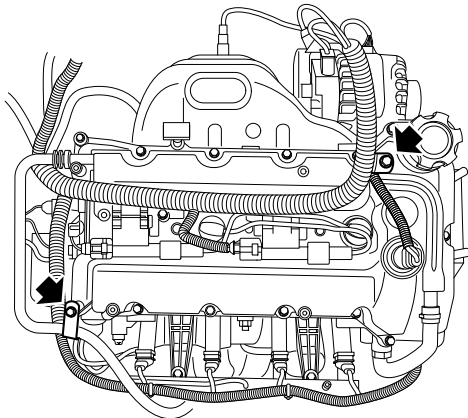
Refit

1. Inspect the top surface of the cylinder head to protect it from any damage, and clean the top surface of the cylinder head, removing any oil.
2. Apply silicone to the seam of the timing chain upper cover plate and the cylinder head with a diameter of 4 mm.



S111C401

2. Loosen and remove the wire harness bracket bolt and the high tension cord bolt, confirm the location of each bolt, and set them aside.

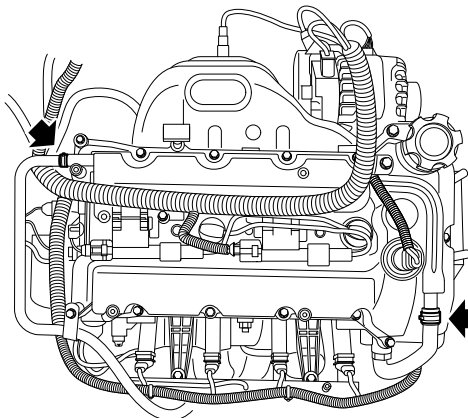


S111C402

3. Remove the high tension cord and the cord bracket.

High Tension Cord Removal

4. Detach the full load and the partial load breather tube clamps.

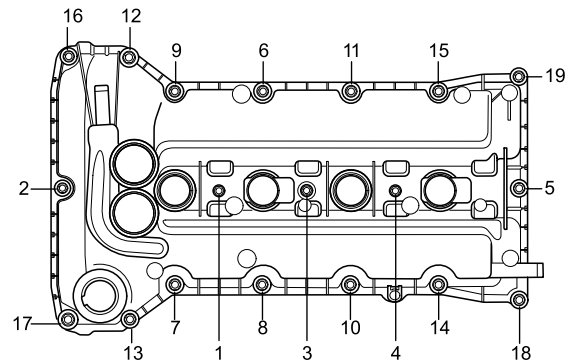


S111C403

5. Remove the full load and the partial load breather tubes.
6. Loosen and remove the 19 bolts securing the camshaft cover, and confirm each location.

S111J402

3. Place the camshaft cover on the cylinder head.
4. Fit the bolts, and tighten them in the order as shown in the illustration below to **8-12 Nm**.



5. Fit the high tension cord and the high tension cord

bracket, and tighten the set bolt to **8–12 Nm**.

 **High Tension Cord Refit**

6. Fit the oil dipstick.

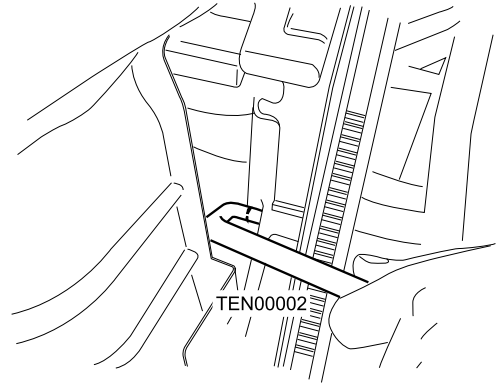
Camshaft - Intake or Exhaust

Removal

1. Disconnect the battery ground.
2. Remove the camshaft cover.

 **Camshaft Cover Removal**

3. Remove the plug fitted into the timing pin hole on the cylinder block.



S111B401

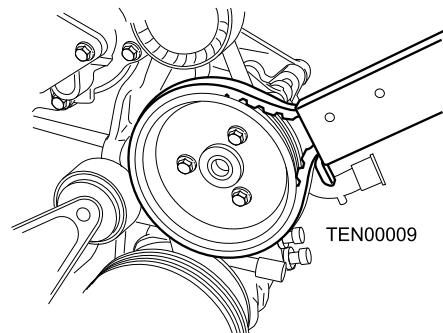
4. Turn the flywheel until the flywheel pin hole is aligned with the cylinder block pin hole.
5. Insert the flywheel timing pin special tool **TEN00002** into the cylinder block timing pin hole and the flywheel pin hole, to lock up the flywheel.
6. Remove the accessory drive belt.

 **Accessory Drive Belt Removal**

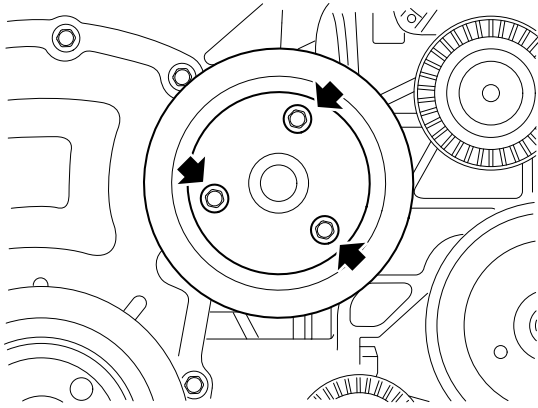
7. Remove the crankshaft pulley.

 **Crankshaft Pulley Removal**

8. Using the pulley replacer special tool **TEN00009**, remove the water pump pulley.



S111J423



S111J404

9. Remove the timing chain upper cover plate.

Timing Chain Upper Cover Plate Removal

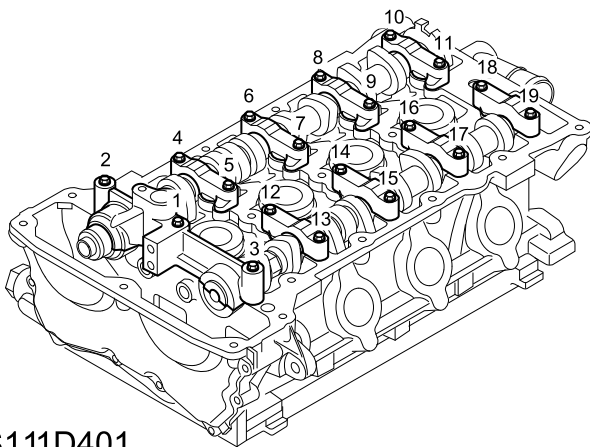
10. Remove the timing chain lower cover plate.

Timing Chain Lower Cover Plate Removal

11. Remove the timing chain.

Timing Chain Removal

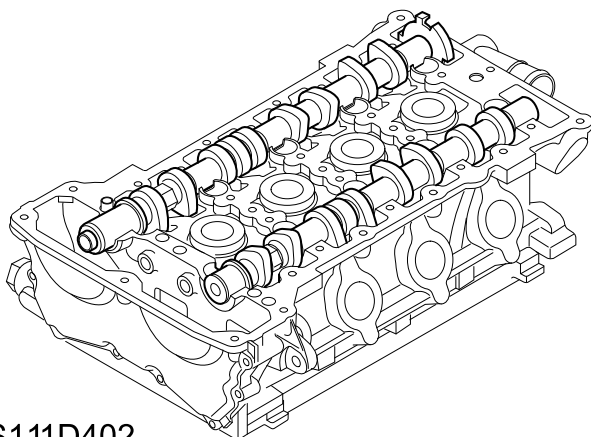
12. Loosen the 19 bolts on the camshaft bearing caps in the order shown in the illustration, until the valve spring pressure is no longer applied to the camshafts.



S111D401

13. Remove the camshaft bearing caps.

14. Remove 2 camshafts.



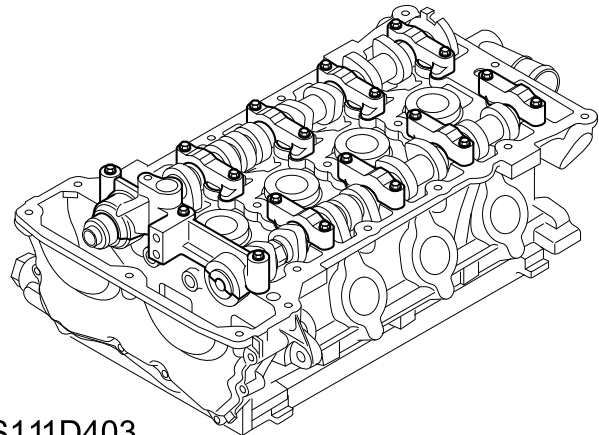
S111D402

Caution: Remove the intake camshaft and the signal plate as an assembly, DO NOT remove the signal plate.

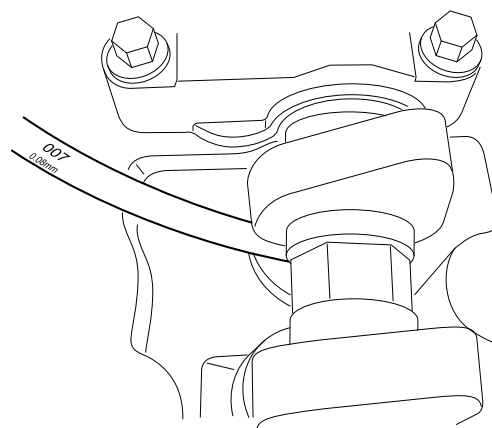
Refit

1. Clean the camshafts.
2. Clean the cylinder head upper surface, mechanical tappet top surfaces and the camshaft bearing caps.
3. Apply oil to the camshaft journals, the bearing seats and the tops of the tappets evenly.
4. Place the camshafts into the bearing seats, fit the camshaft bearing caps, screw the camshaft bolts (without tightening), rotate the camshafts, measure the valve gaps (service model intake side: 0.11 - 0.19 mm, exhaust side: 0.20 - 0.28 mm) and calculate according to the valve gaps to obtain the most suitable mechanical tappets.

Caution: Assemble the intake camshaft and the signal plate as an assembly, DO NOT remove the signal plate.

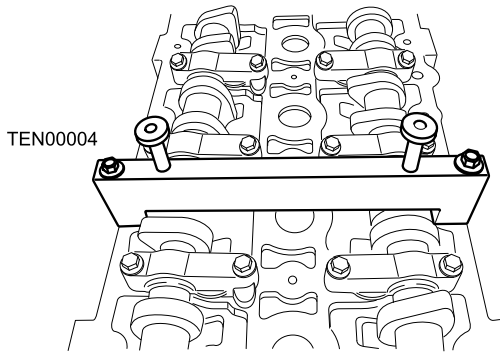


S111D403

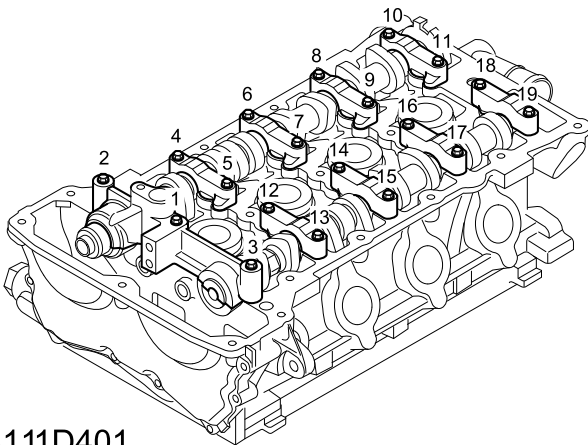


S111D404

5. Replace the mechanical tappets with appropriate ones, place the camshafts into the bearing seats, fit the camshaft bearing caps, screw the camshaft bolts (without tightening), use the camshaft timing special tool **TEN00004** to secure the intake and exhaust camshafts, and tighten the camshaft bearing caps in the order shown in the illustration and the tightening torque is **8-12 Nm**.



S111B408



S111D401

6. Fit the timing chain.

Timing Chain Refit

7. Fit the timing chain upper cover plate.

Timing Chain Upper Cover Plate Refit

8. Fit the timing chain lower cover plate.

Timing Chain Lower Cover Plate Refit

9. Fit the water pump pulley.

10. Fit the crankshaft pulley.

Crankshaft Pulley Refit

11. Fit the accessory drive belt.

Accessory Drive Belt Refit

12. Remove the flywheel timing pin special tool **TEN00002**.

13. Fit the plug.

14. Remove the timing special tool **TEN00004**.

15. Fit the camshaft cover.

Camshaft Cover Refit

16. Connect the battery ground.

Mechanical Tappet

Removal

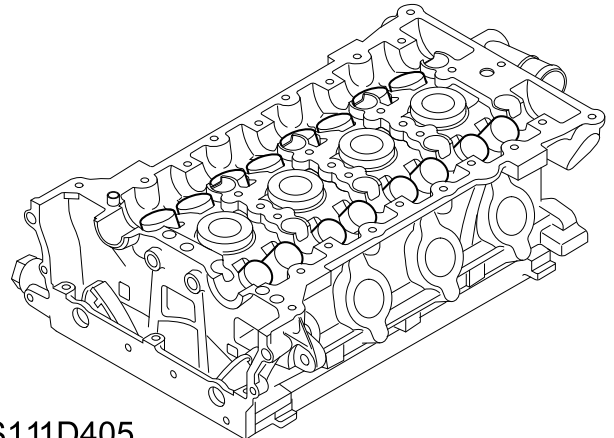
1. Disconnect the battery ground.
2. Remove the camshaft cover.

Camshaft Cover Removal

3. Remove the camshaft - intake or exhaust.

Camshaft - Intake or Exhaust Removal

4. Use a tenacious magnet to remove the mechanical tappets carefully and put them aside.



S111D405

Refit

1. Clean the tappet bores.
2. Lubricate the standard tappets (H group) and fit them to the tappet bores. Fit the camshafts and select the tappet group according to the valve gaps.
3. Fit the selected tappet group.

The valve mechanical tappet series chart is as follows:

| Size# | Part Number | Tappet Thickness |
|-------|-------------|------------------|
| A | 10050424 | 3.015 |
| B | 10050425 | 3.045 |
| C | 10050426 | 3.075 |
| D | 10050427 | 3.105 |
| E | 10050428 | 3.135 |
| F | 10050429 | 3.165 |
| G | 10050430 | 3.195 |
| H | 10050431 | 3.225 |
| I | 10050432 | 3.255 |
| J | 10050433 | 3.285 |
| K | 10050434 | 3.315 |
| L | 10050435 | 3.345 |
| M | 10050436 | 3.375 |
| N | 10050437 | 3.405 |

| | | |
|---|----------|-------|
| O | I0050438 | 3.435 |
| P | I0050439 | 3.465 |
| Q | I0050440 | 3.495 |
| R | I0050441 | 3.525 |
| S | I0050442 | 3.555 |
| T | I0050443 | 3.585 |

4. Fit the camshaft - intake or exhaust.

 **Camshaft - Intake or Exhaust Refit**

5. Fit the camshaft cover.

 **Camshaft Cover Refit**

6. Connect the battery ground.

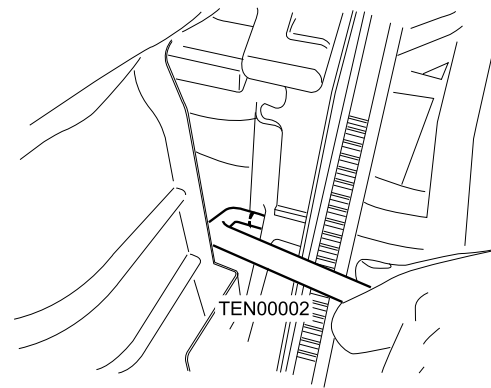
Valve Removal and Refit

Removal

1. Disconnect the battery ground.
2. Remove the camshaft cover.

 **Camshaft Cover Removal**

3. Remove the plug fitted into the timing pin hole on the cylinder block.
4. Turn the flywheel until the flywheel pin hole is aligned with the cylinder block pin hole.
5. Insert the flywheel timing pin special tool **TEN00002** into the cylinder block timing pin hole and the flywheel pin hole, to lock up the flywheel.



S111B401

6. Remove the accessory drive belt.

 **Accessory Drive Belt Removal**

7. Remove the crankshaft pulley.

 **Crankshaft Pulley Removal**

8. Remove the water pump pulley.
9. Remove the timing chain upper cover plate.

 **Timing Chain Upper Cover Plate Removal**

10. Remove the timing chain lower cover plate.

 **Timing Chain Lower Cover Plate Removal**

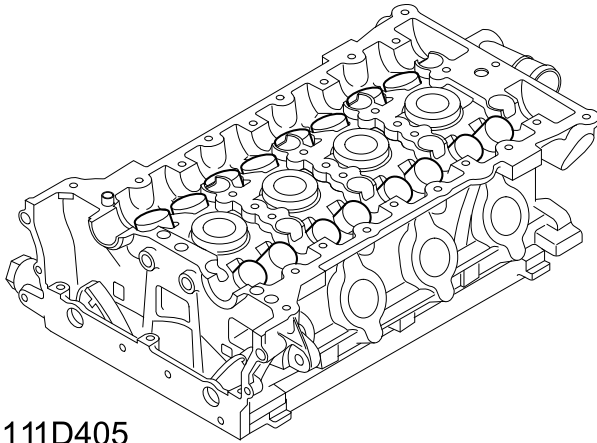
11. Remove the timing chain.

 **Timing Chain Removal**

12. Remove the camshaft - intake or exhaust.

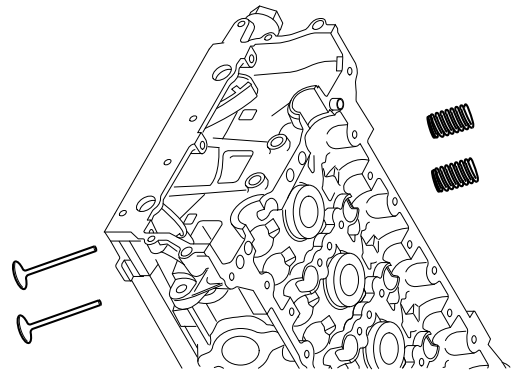
 **Camshaft - Intake or Exhaust Removal**

13. Using a tenacious magnet, take care to remove the 16 mechanical tappets and put them aside.



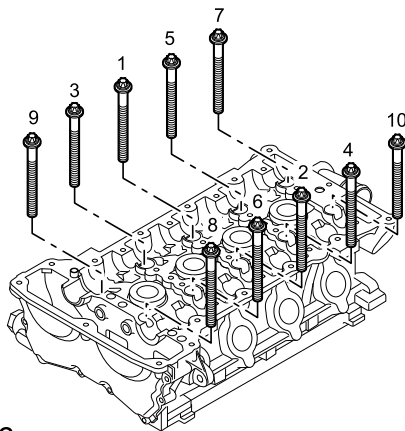
S111D405

14. Remove the cylinder head bolts in the order shown in the illustration, and remove the cylinder head.



S111D408

19. Use the special tool **T10006** to remove the valve oil seal.



S111D406

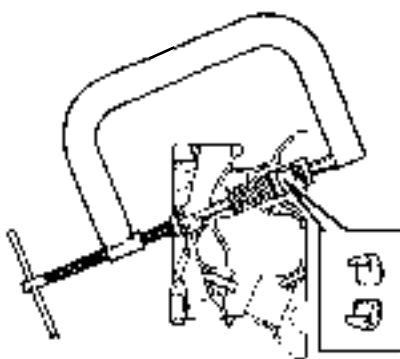
15. Use the special tool **T10005** to compress the valve spring.



S111D409

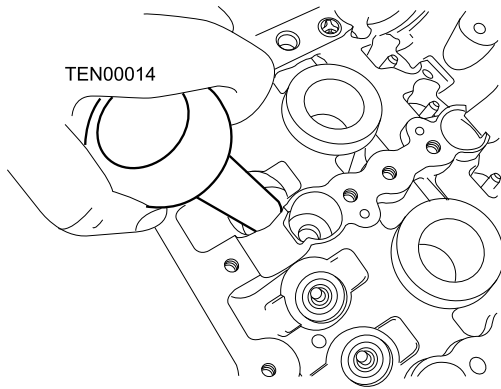
Refit

1. Remove the carbon deposits and other impurities from the valve guide, the valve, the valve retainer and the combustion surface.
2. Check the existing valve stem diameter. Using a new valve, check the valve guide gap.
3. Inspect the conditions of the valve seat and the valve, if they are to be reused.
4. Check the mating height of the valve stem.
5. Check the condition of the valve spring.
6. Make sure that the mechanical tappet, the valve, the valve spring, the spring cover and the keeper are all clean.
7. Lubricate the valve and the valve stem oil seal.
8. Use the special tool **TEN00014** to fit the valve stem oil seal to the valve guide.



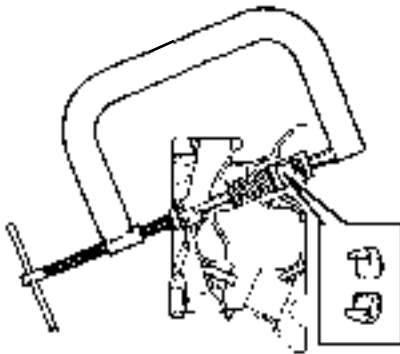
S111D407

16. Remove the valve keeper and release the valve spring.
17. Remove the special tool **T10005**.
18. Remove the valve spring, the valve spring seat and the valve.



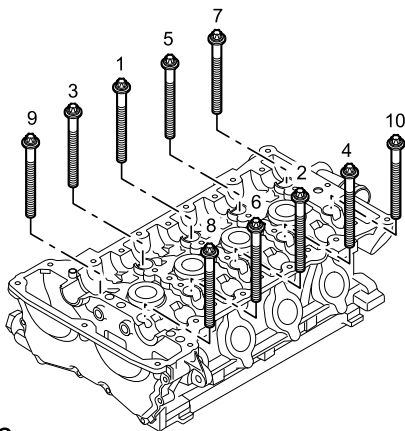
S111D424

9. Fit the valve, the spring and the spring cover, use the special tool **T10005** to compress the valve spring, and fit the keeper.

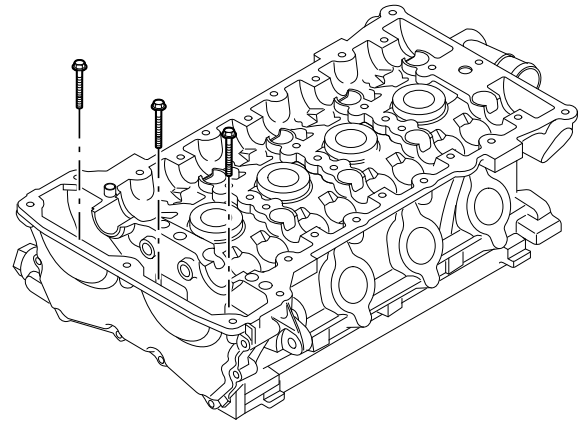


S111D407

10. Release the valve spring and remove the special tool **T10005**.
11. Place the cylinder head on the cylinder block equipped with gasket, and take care to put into 10 cylinder head bolts and 3 chain case bolts.



S111D406



S111D410

12. Tighten the cylinder head bolts in the order shown in the illustration, the tightening torque is **30 Nm + 90°+ 90°+ 45°**, tighten the chain case bolts and the tightening torque is **10-12 Nm**.
13. Lubricate the tappet and the tappet bore, and fit the tappet into the tappet bore.
14. Clean the camshafts and the cylinder head upper mating surface.
15. Lubricate the camshaft journals and the bearing seats.
16. Fit the camshaft - intake or exhaust.

 **Camshaft - Intake or Exhaust Refit**

17. Fit the timing chain.

 **Timing Chain Refit**

18. Fit the timing chain upper cover plate.

 **Timing Chain Upper Cover Plate Refit**

19. Fit the timing chain lower cover plate.


 **Timing Chain Lower Cover Plate Refit**

20. Fit the water pump pulley.

21. Fit the crankshaft pulley.

 **Crankshaft Pulley Refit**

22. Fit the accessory drive belt.

 **Accessory Drive Belt Refit**

23. Remove the flywheel timing pin.

24. Fit the plug.

25. Fit the camshaft cover.

 **Camshaft Cover Refit**

26. Connect the battery ground.

Cylinder Head Assembly

Removal

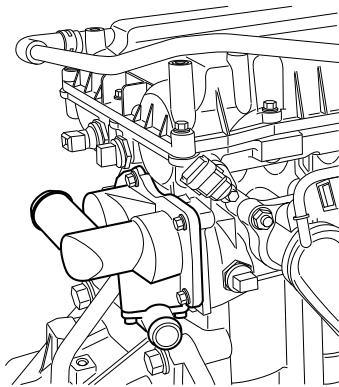
1. Disconnect the battery ground.
2. Remove the generator.

 **Generator Removal**

3. Remove the exhaust manifold and dispose of the exhaust manifold gasket.

 **Exhaust Manifold Removal**

4. Remove the bolts securing the thermostat assembly to the cylinder head, and remove the thermostat assembly.

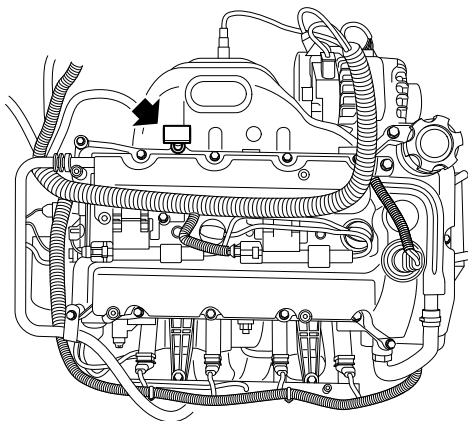


S111D411

5. Remove any dirt at the gaps of the spark plugs.
6. Remove the spark plugs.

 **Spark Plug Removal**

7. Remove the oil dipstick.



S111C401

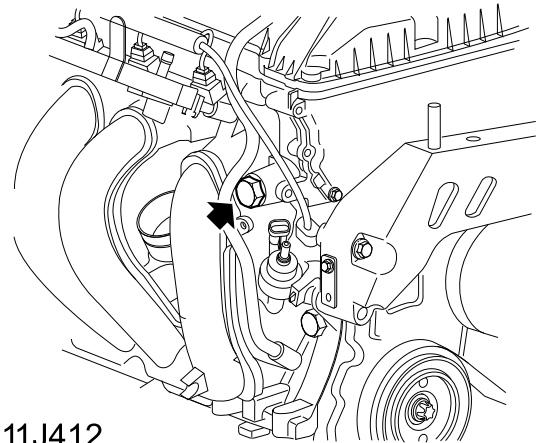
8. Remove the camshaft cover.

 **Camshaft Cover Removal**

9. Remove the timing chain upper cover plate.

 **Timing Chain Upper Cover Plate Removal**

10. Remove the timing chain tensioner.

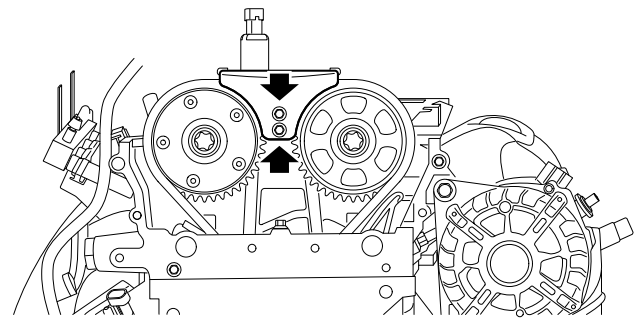


S111J412

11. Remove the oil control valve.

 **Oil Control Valve Removal**

12. Remove the upper guide rail.



S111J413

13. Remove the chain and put it aside.

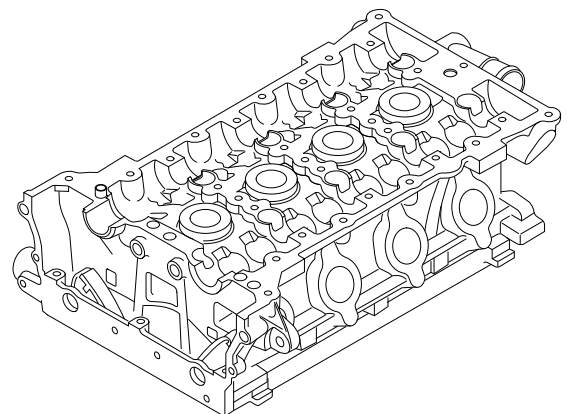
14. Remove the intake and exhaust camshafts.

 **Intake and Exhaust Camshafts Removal**

15. Remove the mechanical tappets.

 **Mechanical Tappet Removal**

16. Remove the cylinder head assembly, and then dispose of the cylinder head gasket.



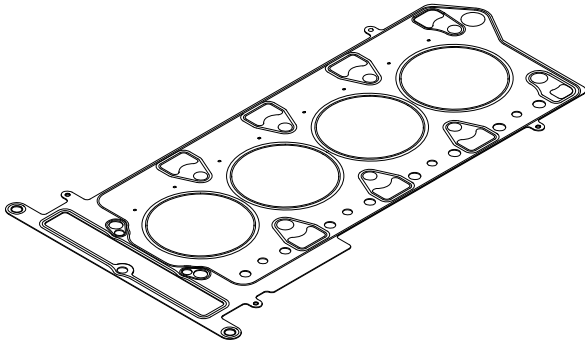
S111D412

17. Remove the intake and exhaust valves.

 **Intake and Exhaust Valves Removal**

Refit

1. Clean the seal areas of the cylinder head and the timing chain upper cover plate. Clean the mating surfaces of the camshaft cover and the intake and exhaust manifolds with defoaming agent and plastic scraper (Note: DO NOT clean the sealing surfaces with a metal scraper).
2. Dry the oil passages and the coolant passages.
3. Use a new cylinder gasket.

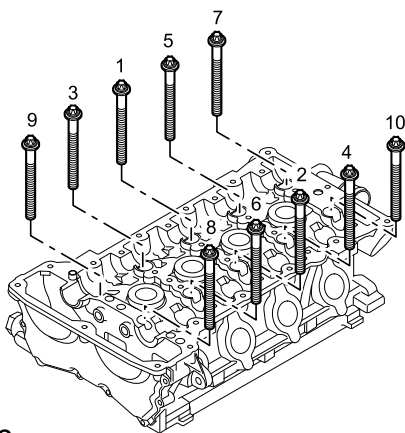


S111D413

4. Fit the intake and exhaust valves.

Intake and Exhaust Valves Refit

5. Place the cylinder head onto the cylinder block, and then pretighten it with bolts (Note: no lubricant should be applied to the cylinder head bolts).
6. Using a special socket, tighten the 10 cylinder head bolts in the order as shown (Torque: **30 Nm + 90° + 90° + 45°**), then tighten the 3 bolts next to the chain case (Torque: **10-12 Nm**).



S111D406

7. Fit the mechanical tappets.

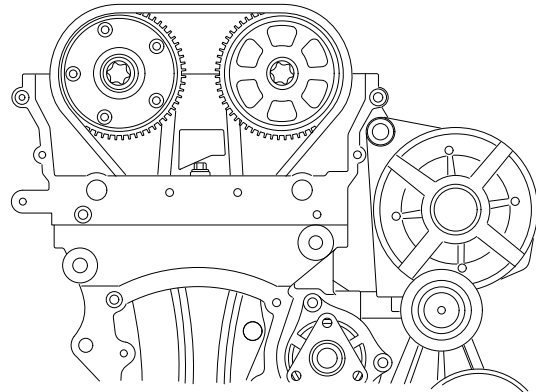
Mechanical Tappet Refit

8. Fit the intake and exhaust camshafts.

Intake and Exhaust Camshafts Refit

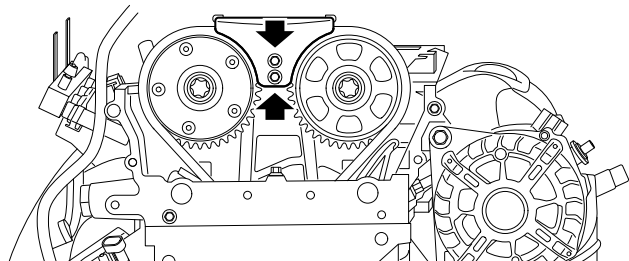
9. Push the oil control bushing into the hole in the intake side camshaft end.
10. Fit the intake phase modulator and exhaust camshaft

sprocket to the corresponding camshaft. Fit the bolts, but DO NOT tighten them. Then engage the chain and the sprocket teeth.



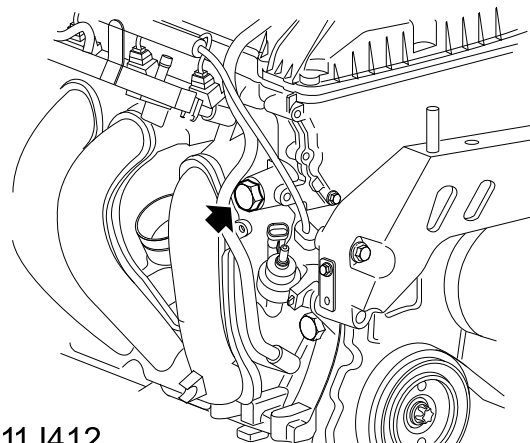
S111D414

11. Tighten the phase modulator and the exhaust sprocket bolts (the phase modulator bolt: **70-80 Nm**, the sprocket bolt: **25 Nm + 45°**).
12. Fit the sprocket upper guide rail on the camshaft front bearing cap, fit 2 bolts, tighten them and the torque is **8-12 Nm**.



S111J413

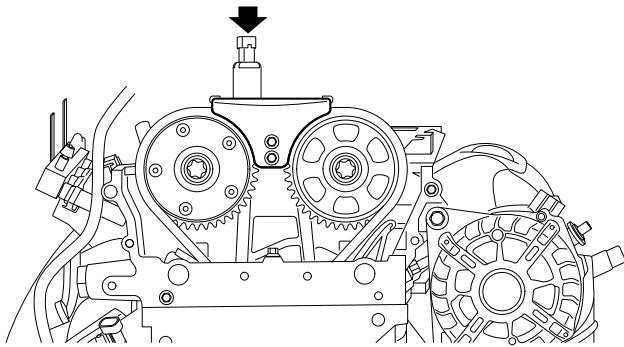
13. Fit the timing chain tensioner, and the torque is **57-63 Nm**.



S111J412

14. Fit the oil control valve bolt, and the torque is **5-7 Nm**.

Oil Control Valve Refit



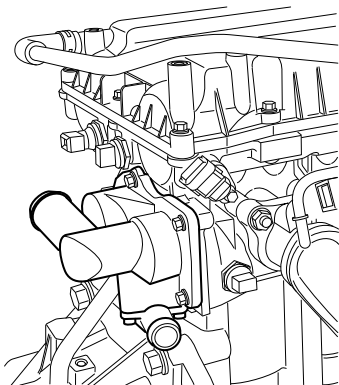
- Fit the timing chain upper cover plate, and the torque is **8-12 Nm**.

Timing Chain Upper Cover Plate Refit

- Fit the camshaft cover assembly, and the torque is **8-12 Nm**.

Camshaft Cover Refit

- Insert the dipstick into the dipstick hole.
- Fit the thermostat housing, and tighten it to **8-12 Nm**.



S111D411

- Fit the intake manifold.

Intake Manifold Refit

- Fit the exhaust manifold and a new exhaust manifold gasket.

Exhaust Manifold Refit

- Fit the generator, and the torque is: **40-50 Nm**.

Generator Refit

- Fit the spark plugs, and the torque is **20-30 Nm**.

Spark Plug Refit

- Connect the battery ground.

Cylinder Head Inspection

Removal

- Disconnect the battery ground.
- Remove the generator.

Generator Removal

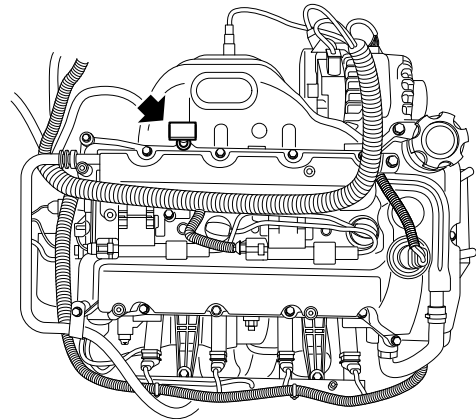
- Remove the exhaust manifold and dispose of the exhaust manifold gasket.

Exhaust Manifold Removal

- Unscrew the bolts securing the thermostat assembly to the cylinder head, and remove the thermostat assembly.
- Remove any dirt in the spark plug gaps.
- Remove the spark plugs.

Spark Plug Removal

- Remove the oil dipstick.



S111C401

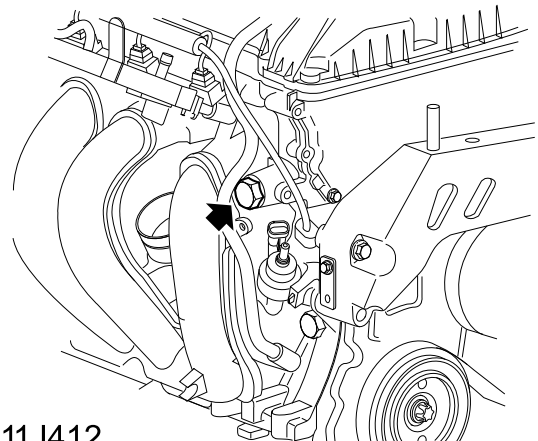
- Remove the camshaft cover.

Camshaft Cover Removal

- Remove the timing chain upper cover plate.

Timing Chain Upper Cover Plate Removal

- Remove the timing chain tensioner.

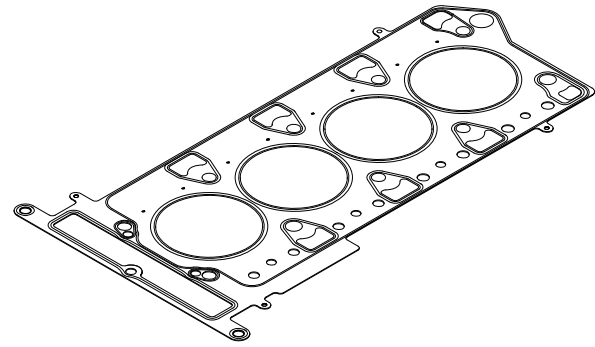
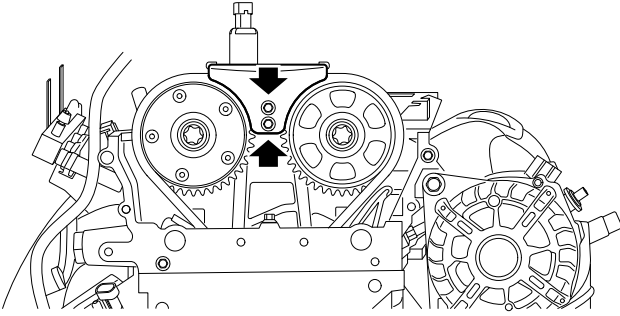


S111J412

- Remove the oil control valve.

Oil Control Valve Removal

- Loosen the bolts securing the sprocket upper guide rail, and remove the sprocket upper guide rail.

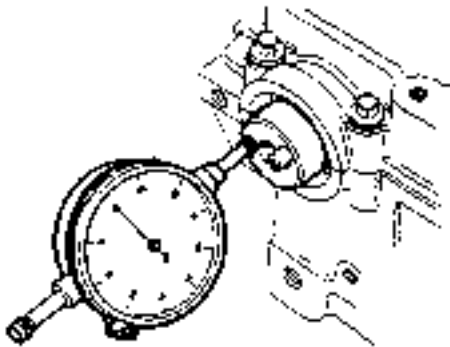


S111J413

- 13. Remove the chain and put it aside.
- 14. Remove the cylinder head assembly and dispose of the cylinder head gasket.

Cylinder Head Assembly Removal

- 15. Using a dial test indicator, check the end play of the camshaft.



S111D415

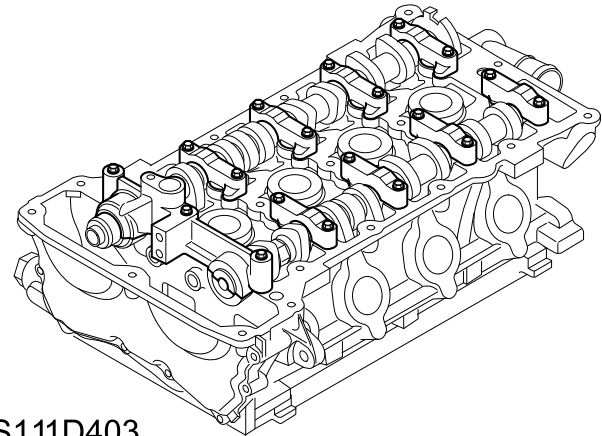
- 16. If the end play exceeds the tolerance, replace the camshaft with a new one and check it again. If the end play still exceeds the tolerance, replace the cylinder head assembly.

| | |
|---------------------|--------------|
| Camshaft End Play: | 0.06 0.19 mm |
| Service Value Limit | 0.30 mm |

- 17. Loosen the cylinder head bolts gradually, remove the cylinder head assembly and put it on the wooden block. Be careful to protect the flame face and avoid scratches.
- 18. Remove and dispose of the cylinder head gasket.

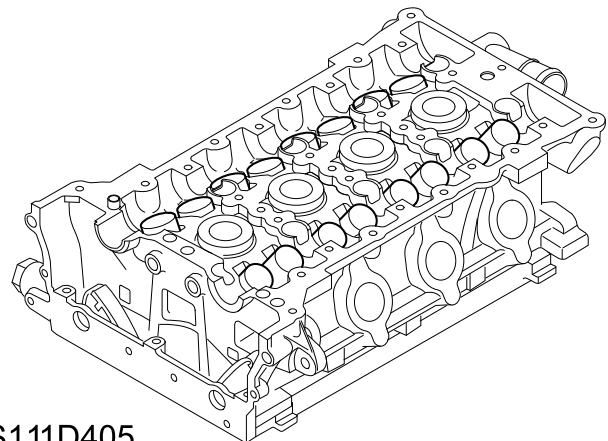
S111D413

- 19. Loosen the bolts securing the camshaft bearing caps, identify the position of each camshaft bearing cap and remove the camshaft bearing caps.



S111D403

- 20. Identify the position of each camshaft and remove the camshafts.
- 21. Remove the 16 mechanical tappets from the cylinder head, and arrange them in order to avoid misuse.

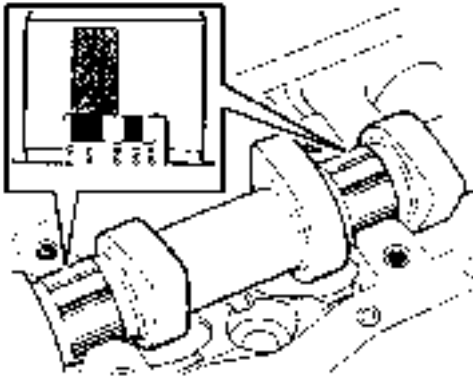


S111D405

- 22. Measure the outer diameter of each mechanical tappet (Outer diameter of mechanical tappet: 29.980 – 29.964).
- 23. Clean the camshafts, camshaft bearing caps and cylinder head bearing seats.
- 24. Check the camshafts and replace them if there are

scratches, dents or excessive wear.

- 25. Secure the camshafts onto the cylinder head, and place a plastic gauge on each journal. Then fit the camshaft bearing caps, and DO NOT turn the camshafts.
- 26. Loosen the camshaft bearing cap bolts slowly and remove the camshaft bearing caps.

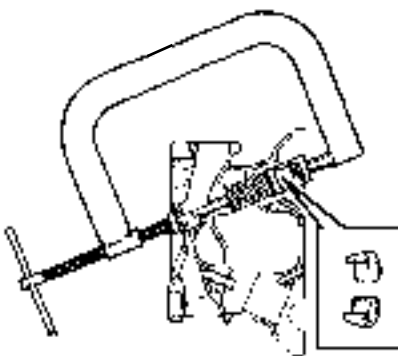


S111D416

- 27. Measure the widest part of the plastic gauge on each journal. If the gap exceeds the tolerance, replace the camshaft with a new one and check it again. If the gap still exceeds the tolerance, replace the cylinder head assembly with a new one.

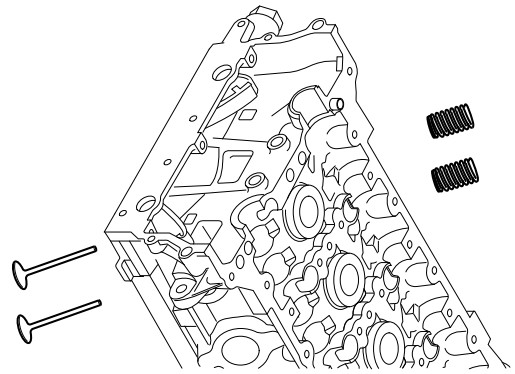
| | Bearing Backlash | Service play |
|-----------------|------------------|--------------|
| First Journal | 0.025 0.066 mm | 0.1 mm |
| Last 4 Journals | 0.024 0.066 mm | 0.1 mm |

- 28. Support the exhaust manifold side of the cylinder head with a wooden block, and remove the intake valves in this position.
- 29. Use the special tool **T10005** to compress the valve spring, remove 2 keepers from the valve, release the valve spring and then remove the tool.



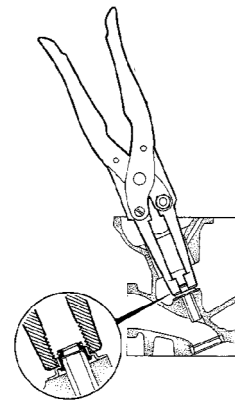
S111D407

- 30. Remove the remaining valve spring seat, valve spring and valve. Place them aside in the original fitting order.



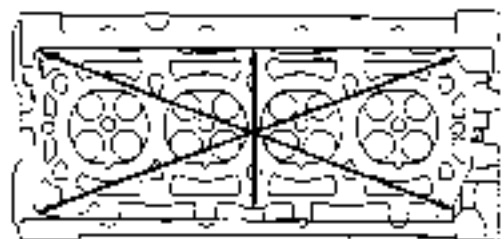
S111D408

- 31. Use the special tool **T10006** to remove the valve oil seal.



S111D409

- 32. Clean each joint surface of the cylinder head.
- 33. Check the cylinder head for damage, especially the flame face of the cylinder head.
- 34. Check if there are scratches on the flame face of the cylinder head. The check should be performed crosswise as shown, or from one corner to the other.

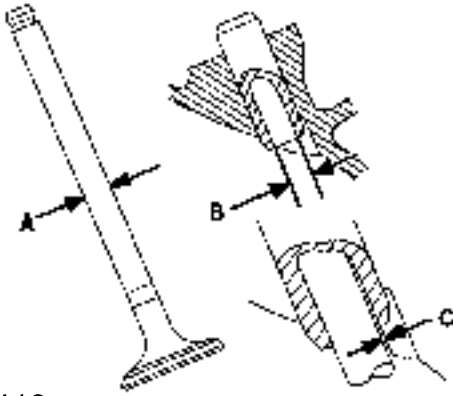


S111D417

- 35. Check the height of the cylinder head. The cylinder head can be resurfaced and the maximum amount is 0.20 mm.

| | |
|-------------------------|------------------|
| Height of Cylinder Head | |
| New | 118.95 119.05 mm |
| Resurfacing Value Limit | 0.20 mm |

36. Clean the carbon deposits off the surfaces of valves, valve guides, valve seats and combustion chambers.



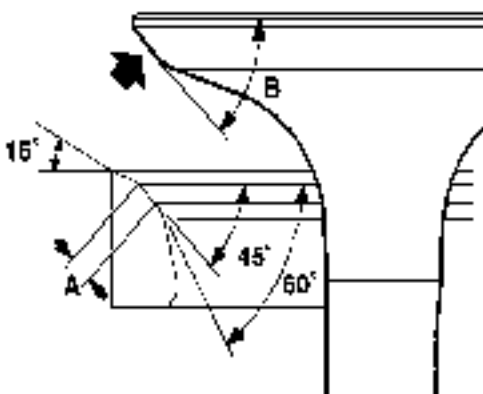
S111D418

37. Check the diameters of the existing valve stems, and use a new valve to check the gaps of the valve guides.

| | |
|---|----------------|
| Valve Stem Diameter: | |
| Intake Valve | 5.952 5.967 mm |
| Exhaust Valve | 5.947 5.962 mm |
| Gap between valve stem and valve guide: | |
| Intake Valve | 0.033 0.073 mm |
| Exhaust Valve | 0.038 0.078 mm |

If necessary, replace the valve with a new one. If it is necessary to replace the valve guide, replace the cylinder head assembly.

38. If the cylinder head is to be reused, check the condition of the valve seats and valves.



S111D419

39. Machine the valve surface angle and valve seats to meet the following standards:

| | |
|------------------------|--------|
| Valve Seat: | |
| Angle | 45° |
| Width A: | |
| Intake | 1.2 mm |
| Exhaust | 1.6 mm |
| Valve Surface Angle B: | |
| Intake | 45° |
| Exhaust | 45° |

40. Press the valve to the seat with even abrasive compound.
41. Coat the valve seat with Prussian blue, put the valve in and press it in place without turning. Remove the valve and check if the Prussian blue is even and the seat is in the centre. The shown blue position of the seat must be in the centre of the valve surface.
42. Coat the valve seat and check again.
43. Check the mating height of the valve stem.

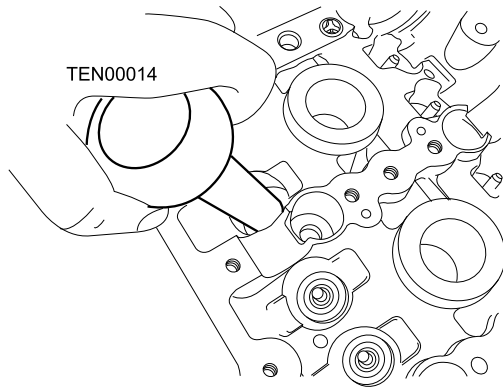
| | |
|-------------------|--------------------|
| New Intake Valve | 50.021 50.881 mm |
| New Exhaust Valve | 49.925 - 50.785 mm |
| Service Limit | 0.26 mm |

44. If the limit is still exceeded, the cylinder head assembly must be replaced.
45. Check the condition of the valve spring:

| | |
|----------------------------|-------------|
| Free Length | 50 mm |
| Refit Length | 37.0 mm |
| Load - Valve Closes | 250 ± 12 Nm |
| Load - Intake Valve Opens | 442 ± 18 Nm |
| Load - Exhaust Valve Opens | 464 ± 18 Nm |

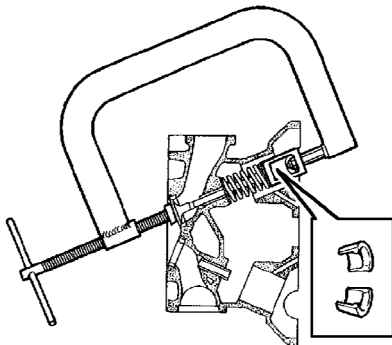
Refit

1. Clean the sealing areas of the cylinder head and timing chain upper cover plate. Clean the mating surfaces of the camshaft cover and the intake and exhaust manifolds with defoaming agent and plastic scraper (Note: DO NOT clean the sealing surface with a metal scraper).
2. Dry the oil passages and coolant passages with air.
3. Using **TEN00014**, fit new valve stem oil seals.



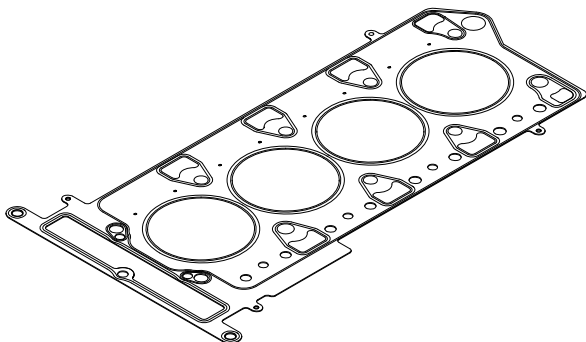
S111D424

4. Lubricate the valve stem and valve assemblies, and use the tool **T10005** to compress the valve spring. Fit the intake and exhaust valves, valve springs, valve spring seats and the valve keepers.



S111D407

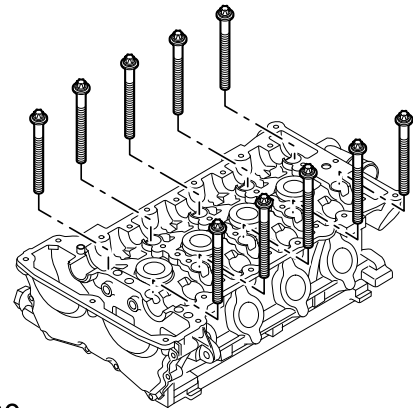
5. Fit a new cylinder gasket.



S111D413

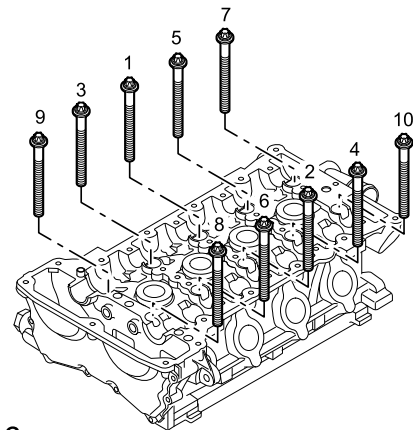
6. Place the cylinder head onto the cylinder block, and then pretighten it with bolts.

Warning:

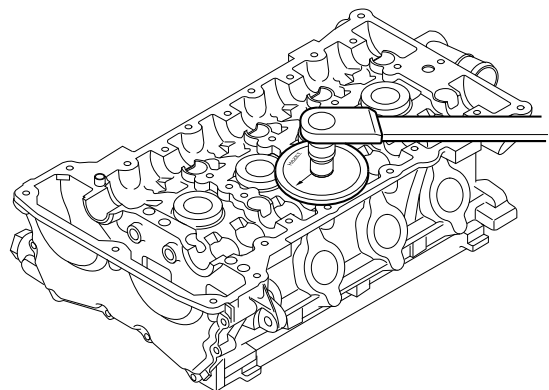


S111D420

7. Using a special socket, tighten the 10 cylinder head bolts in the order as shown (Torque: **30 Nm + 90° + 90° + 45°**), and then tighten the 3 bolts near the chain case (Torque: **10-12 Nm**).

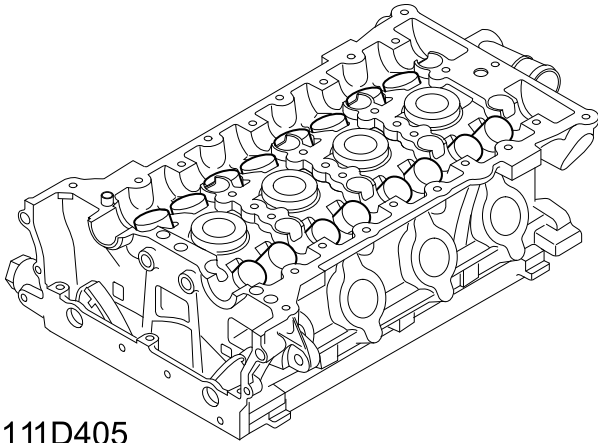


S111D406



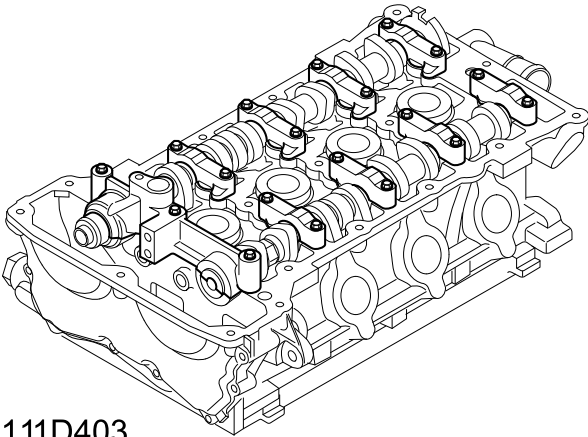
S111D421

8. Lubricate the outsides of the mechanical tappets, and fit them to their original positions.



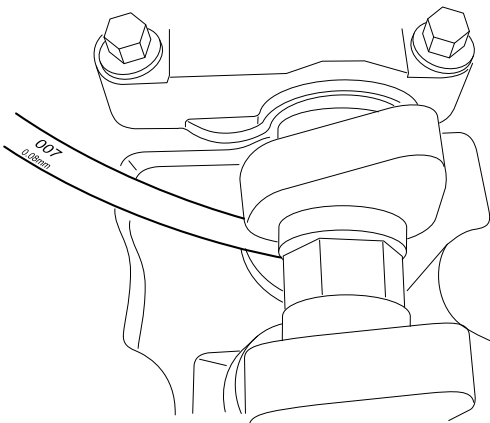
S111D405

- Lubricate the surfaces of camshaft bearings and place the camshafts on the cylinder head. Then fit the camshaft bearing caps to correct positions and pretighten them with bolts.



S111D403

- Measure the gap of each mechanical tappet by: turn the camshaft to locate the base circle above the mechanical tappet, measure and record the gap between the camshaft and mechanical tappet. Repeat the same operation for every mechanical tappet. Calculate the gap and select the proper mechanical tappet to ensure correct gap. Intake side gap: 0.11 - 0.19 mm, exhaust side gap: 0.20 - 0.28 mm.

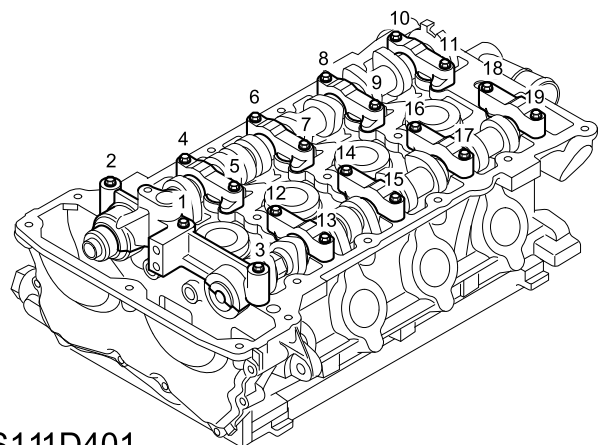


S111D404

The valve mechanical tappet series chart is as follows:

| Size # | Part Number | Tappet Thickness |
|--------|-------------|------------------|
| A | I0050424 | 3.015 |
| B | I0050425 | 3.045 |
| C | I0050426 | 3.075 |
| D | I0050427 | 3.105 |
| E | I0050428 | 3.135 |
| F | I0050429 | 3.165 |
| G | I0050430 | 3.195 |
| H | I0050431 | 3.225 |
| I | I0050432 | 3.255 |
| J | I0050433 | 3.285 |
| K | I0050434 | 3.315 |
| L | I0050435 | 3.345 |
| M | I0050436 | 3.375 |
| N | I0050437 | 3.405 |
| O | I0050438 | 3.435 |
| P | I0050439 | 3.465 |
| Q | I0050440 | 3.495 |
| R | I0050441 | 3.525 |
| S | I0050442 | 3.555 |
| T | I0050443 | 3.585 |

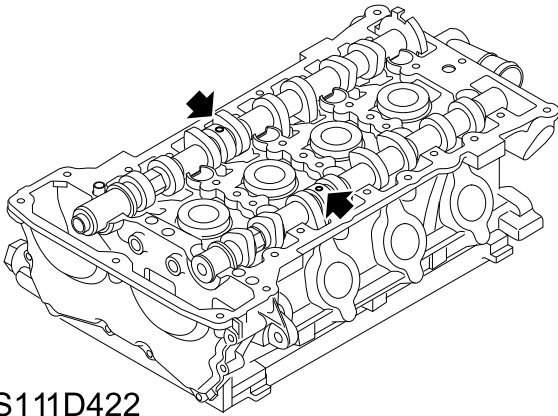
- Remove the camshafts and fit the mechanical tappet of correct size to the corresponding position. Fit the camshafts using the previous method and check the gaps.
- Tighten the bolts securing the bearings in the order as shown and the torque is **8-12 Nm**. Then turn the camshaft two turns and measure the rotational torque (Note: it is necessary to rotate).



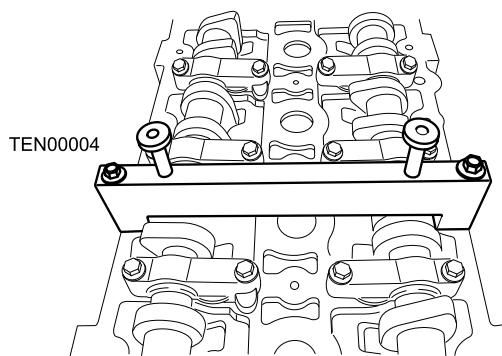
S111D401

- Apply clean oil to the mechanical tappets. Turn the camshafts to make the timing holes face upward, then use the camshaft timing special tool **TEN00004** to

secure the camshafts. Adjust the crankshaft position to 90 degrees before the top dead centre of cylinder 1 (Note: crankshaft angle). Then insert the flywheel timing pin special tool **TEN00002** into the cylinder block timing pin hole and flywheel pin hole, to lock up the flywheel.

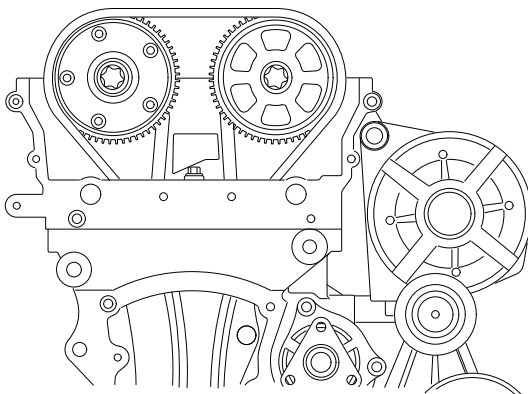


S111D422



S111B408

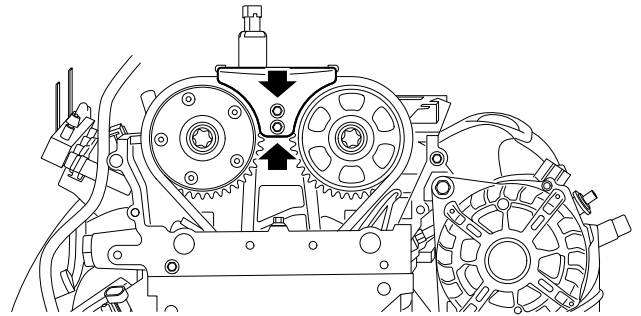
14. Press the oil control bushing into the hole in the intake side camshaft end. Fit the intake phase modulator and exhaust camshaft sprocket to the corresponding camshaft. Fit the bolts, but **DO NOT** tighten them. Then engage the chain and sprocket teeth.



S111D414

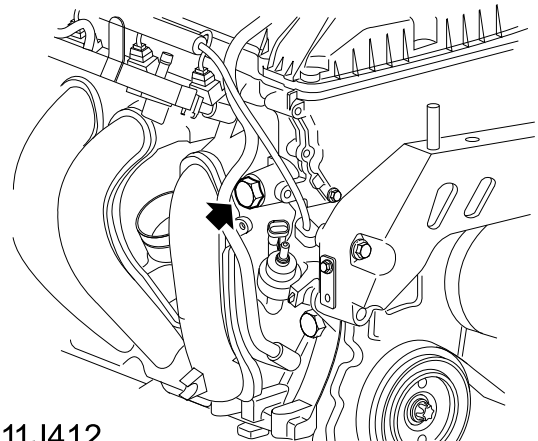
15. Tighten the intake phase modulator and exhaust camshaft sprocket bolts (Timing chain bolt: **70-80 Nm**, sprocket bolt: **25 Nm + 45°**).

16. Fit the sprocket upper guide rail to the camshaft front bearing cap. Fit 2 bolts, tighten them and the torque is **8-12 Nm**.



S111J413

17. Fit the timing chain tensioner to the cylinder head, tighten it, and the torque is **57-63 Nm**.



S111J412

18. Fit the oil control valve, and the torque is **5-7 Nm**.

 **Oil Control Valve Refit**

19. Fit the timing chain upper cover plate, and the torque is **8-12 Nm**.

 **Timing Chain Upper Cover Plate Refit**

20. Fit the camshaft cover assembly, and the torque is **8-12 Nm**.

 **Camshaft Cover Refit**

21. Insert the oil dipstick into the dipstick hole.
22. Fit the thermostat housing and tighten it to **8-12 Nm**.
23. Fit the intake manifold.

 **Intake Manifold Refit**

24. Fit the exhaust manifold and a new exhaust manifold gasket.

 **Exhaust Manifold Refit**

25. Fit the generator, and the torque is: **40-50 Nm**.

 **Generator Refit**

26. Fit the spark plugs, and the torque is **20-30 Nm**.

 **Spark Plug Refit**

27. Connect the battery ground.

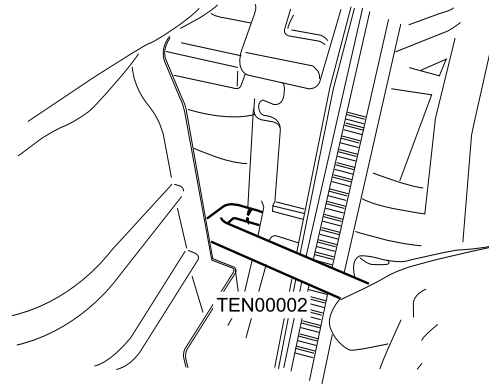
Cylinder Gasket

Removal

1. Disconnect the battery ground.
2. Remove the camshaft cover.

 **Camshaft Cover Removal**

3. Remove the plug fitted into the timing pin hole on the cylinder block.
4. Turn the flywheel until the flywheel pin hole is aligned with the pin hole on the cylinder block.



S111B401

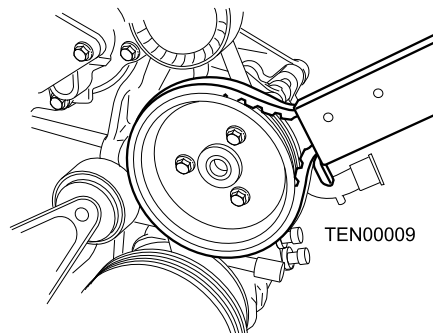
5. Insert the flywheel timing pin special tool **TEN00002** into the cylinder block timing pin hole and flywheel pin hole, to lock up the flywheel.
6. Remove the accessory drive belt.

 **Accessory Drive Belt Removal**

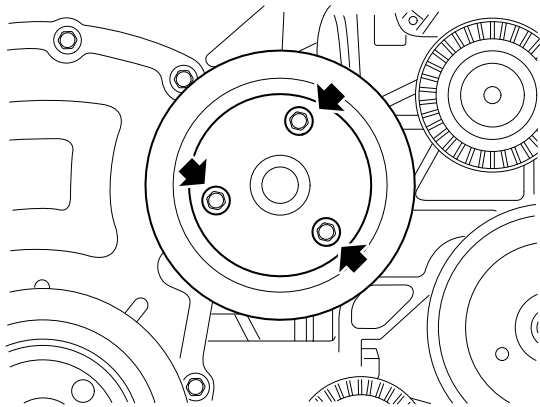
7. Remove the crankshaft pulley.

 **Crankshaft Pulley Removal**

8. Using the special pulley replacer tool **TEN00009**, remove the water pump pulley.



S111J423



S111J404

9. Remove the timing chain upper cover plate.

 **Timing Chain Upper Cover Plate Removal**

10. Remove the timing chain lower cover plate.

 **Timing Chain Lower Cover Plate Removal**

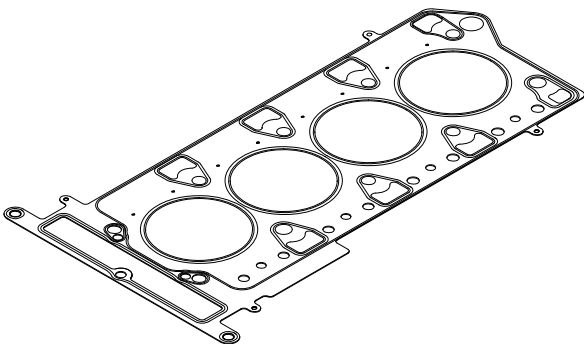
11. Remove the timing chain.

 **Timing Chain Removal**

12. Remove the cylinder head assembly.

 **Cylinder Head Assembly Removal**

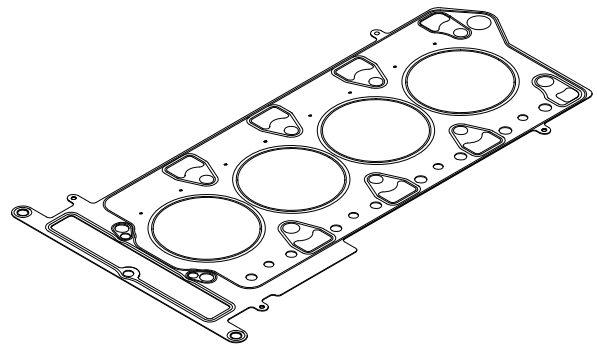
13. Remove the cylinder head gasket from the cylinder block and dispose of it.



S111D413

Refit

1. Clean the mating surfaces of the cylinder head and cylinder block.
2. Check if there is any scratch on the surface of the cylinder head.
3. Check the height of the cylinder head.
4. Clean the oil and coolant passages.
5. Clean the cylinder head bolts and dry them, and check the threads for damage.
6. Apply a thin layer of oil on the threads of the cylinder head bolts.
7. Fit a new and clean cylinder head gasket to the cylinder block.



S111D413

8. Fit the cylinder head assembly.

 **Cylinder Head Assembly Refit**

9. Fit the timing chain.

 **Timing Chain Refit**

10. Fit the timing chain upper cover plate.

 **Timing Chain Upper Cover Plate Refit**

11. Fit the timing chain lower cover plate.

 **Timing Chain Lower Cover Plate Refit**

12. Fit the water pump pulley.

13. Fit the crankshaft pulley.

 **Crankshaft Pulley Refit**

14. Fit the accessory drive belt.

 **Accessory Drive Belt Refit**

15. Remove the flywheel timing pin special tool **TEN00002**.

16. Fit the plug.

17. Fit the camshaft cover.

 **Camshaft Cover Refit**

18. Connect the battery ground.

Lower Crank Case

Removal

1. Disconnect the battery negative terminal.
2. Lift up the front part of the vehicle.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

3. Drain the engine oil.
4. Remove the oil filter.

Oil Filter Removal

5. Remove the front exhaust pipe assembly.

Front Exhaust Pipe Assembly Removal

6. Remove the accessory drive belt.

Accessory Drive Belt Removal

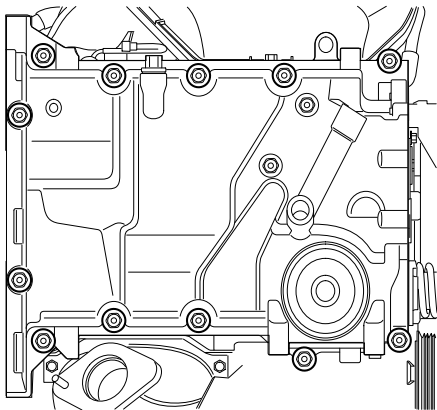
7. Remove the crankshaft rear oil seal cover plate.

Crankshaft Rear Oil Seal Removal

8. Remove the timing chain lower cover plate.

Timing Chain Lower Cover Plate Removal

9. Release the oil pump chain.
10. Remove all the fastening bolts from the lower crank case to the cylinder block.



S1111401

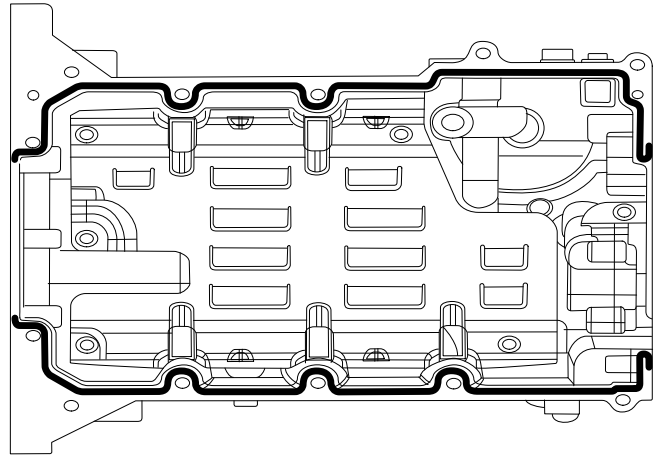
11. Remove the lower crank case.

Refit

1. Make sure the lower crank case and the cylinder block mating surfaces are clean.
2. Fit the oil pump chain.
3. Fit the crankshaft rear oil seal cover plate.

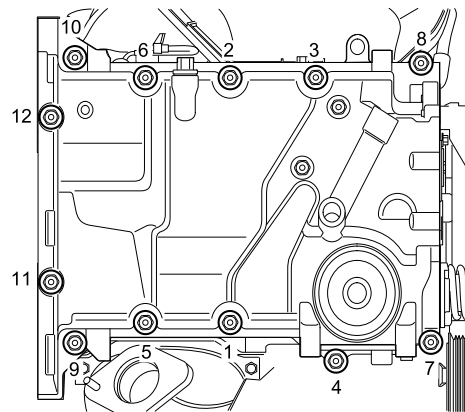
Crankshaft Rear Oil Seal Refit

4. Please apply the sealant recommended by SAIC Motor to the lower crank case mating surface and assemble them.



Caution: When fitting the lower crankcase, try to make the lower crankcase close to the flywheel end as near as possible to avoid creating a gap when connecting the lower crankcase and the transmission case.

5. In the order shown in the illustration, gradually tighten the lower crank case bolts to **22-30 Nm**.



S1111402

6. Fit the timing chain lower cover plate.

Timing Chain Lower Cover Plate Refit

7. Fit the accessory drive belt.

Accessory Drive Belt Refit

8. Fit the front exhaust pipe assembly.

Front Exhaust Pipe Assembly Refit

9. Remove the supports and lower the vehicle.

10. Fit a new oil filter.

Oil Filter Refit

11. Add oil to the engine.
12. Connect the battery ground.

Connecting Rod Bearing Inspection

Removal

1. Remove the accessory drive belt.

 **Accessory Drive Belt Removal**

2. Remove the timing chain upper cover plate.

 **Timing Chain Upper Cover Plate Removal**

3. Remove the timing chain lower cover plate.

 **Timing Chain Lower Cover Plate Removal**

4. Remove the timing chain.

 **Timing Chain Removal**

5. Cylinder head assembly.

 **Cylinder Head Assembly Removal**

6. Remove the engine flywheel or the torque converter drive plate.

 **Manual Flywheel Removal**

 **Torque Converter Drive Plate Removal**

7. Remove the crankshaft rear oil seal.

 **Crankshaft Rear Oil Seal Removal**

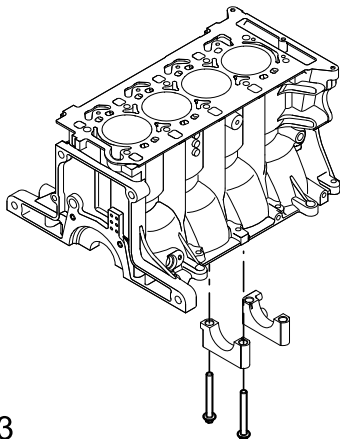
8. Remove the lower crank case assembly.

 **Lower Crank Case Removal**

9. Fit the crankshaft pulley bolt, and gently turn it.
10. On the connecting rod big ends, mark the order of the cylinders to which the connecting rods are fitted.

Caution: Keep the connecting rod big end caps, bearings and bolts in their original refit order.

11. Turn the crankshaft pulley bolt to rotate the crankshaft so that all the connecting rod bolts can be removed easily.
12. Unscrew the connecting rod bolts and remove the connecting rod lower end caps (connecting rod big end caps).



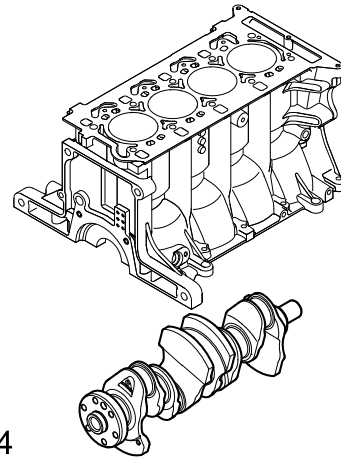
S111A403

13. Remove the connecting rod bearings from the connecting rod lower end caps (connecting rod big end caps).
14. Gently push the piston connecting rod assemblies out

of the cylinder bores from the flame face with a tool such as the plastic stick or wooden stick, and remove the remaining connecting rod bearings.

Caution: When fitting the piston, DO NOT scratch the cylinder liner with the connecting rod fracture.

15. Remove the main bearing cap bolts and main bearing caps, and remove the main bearings from the bearing seats.
16. Remove the crankshaft.



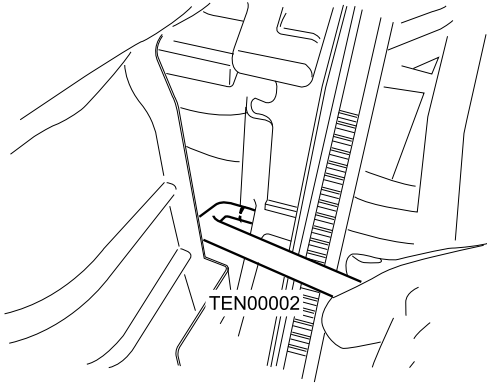
S111A404

17. Remove the 2 thrust washers from the fifth main bearing position.
18. Remove the main bearings from the cylinder block.

Refit

1. Clean the mating surfaces of the cylinder block and bearing seats.
2. Clean the pin and pin hole.
3. Clean the fitting positions for the bearings and thrust washers in the cylinder block.
4. Clean the fitting positions for the bearings on the bearing seats.
5. Clean the fitting positions for the bearings on the connecting rods and caps.
6. Clean the crankshaft and check if it is damaged.
7. Align the two connecting rod bearings with the bearing grooves, and press them into the connecting rod big end hole respectively. Make sure the end surfaces of the bearings are flush with the fracture surface of the connecting rod big end hole as much as possible.

Caution: The connecting rod bearings are not grouped.



Flywheel Refit

Torque Converter Refit

18. Fit the crankshaft rear oil seal.

Crankshaft Rear Oil Seal Refit

19. Fit the cylinder head assembly.

S111B401

Caution: Record the main bearing mark number on the front of the crankshaft.

8. Check the diameter of the crankshaft main journal (Refer to "Parameter").

Parameter

9. Determine the proper main bearing to fit in accordance with the selected size and model (Refer to "Parameter").

Parameter

Caution: The bearings with oil grooves and oil holes are fitted in the main bearing holes of the cylinder block, and bearings without oil grooves and oil holes are fitted in the main bearing caps.

10. The matching rule of the main bearing: the upper bearings are grouped according to the size of the cylinder block (A stands for blue and B for red).
11. Lower bearings are grouped by the crankshaft size (1 stands for blue and 0 for red).
12. Clean the seal surfaces of the cylinder block and the bearing seats with a cloth free of rough edges and appropriate solvent.

Tip: Please use SAIC Motor recommended cleaning solvent to remove the remaining sealer.

13. Fit the selected crankshaft main bearings to the cylinder block and bearing seats.
14. Clean both sides of the cylinder block fourth main bearing and fit new thrust washers to them.

Tip: The oil groove surface of the thrust washer is the surface contacting with the crankshaft thrust surface, and never fit it reversely.

15. Fit the crankshaft and then the main bearing caps.
Torque: $(20 \pm 2) \text{ Nm} + 90^\circ + (45 \pm 2)^\circ$.
16. Put the piston connecting rod set in the guide sleeve and press it into the cylinder. Fit the connecting rod big end cap. Torque: $(18 \pm 2) \text{ Nm} + (90 \pm 5)^\circ$.
17. Fit the manual flywheel or the torque converter drive plate.

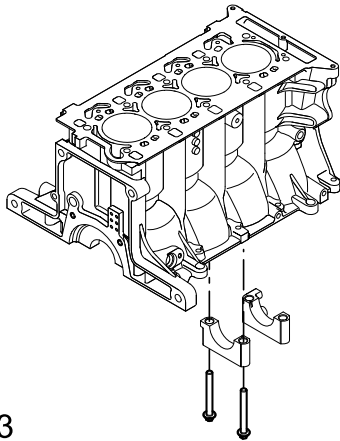
Piston Inspection

Removal

1. Remove the cylinder head assembly.

 **Cylinder Head Assembly Removal**

2. Loosen the connecting rod bolts.



S111A403

3. Remove the connecting rod cap.
4. Remove the connecting rod bearing.
5. Push the piston to the top of the cylinder bore.

Caution: Remove the carbon deposits on the top of the cylinder bore first to avoid scratching the piston rings and the piston.

6. Make sure the connecting rod does not contact to the inner wall of the cylinder bore. Carefully push the piston assembly out of the cylinder bore.

Caution: Please carefully mark each piston and matched liner.

7. Fit the connecting rod big end cap to the connecting rod, and gently tighten the connecting rod bolts.
8. Remove the used piston rings with an expander (tool), and dispose of them.

Refit

1. Clean the ring grooves of the piston and dry the oil passage with air.
2. Position a new piston ring at 20 mm from the cylinder bore top surface, and measure the gap.



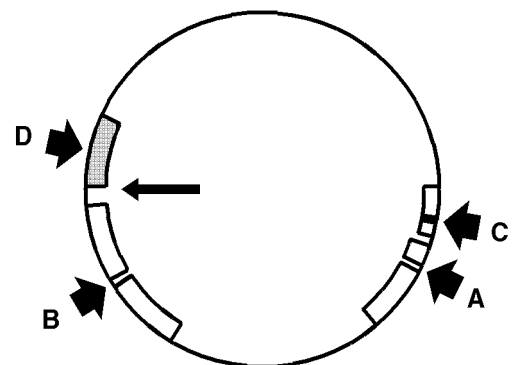
S111A405

3. Check if the piston is deformed or cracked.
4. At a right angle to the piston pin, measure the piston diameter at the measuring point 11 mm up from under the skirt portion (Refer to "Parameter").

 **Parameter**

Caution: Pistons and connecting rods are only supplied as assemblies, and as the connecting rods are grouped according to weight, be sure that the piston connecting rod assemblies of the four cylinders are of the same weight.

5. Fit the oil ring spring.
6. Make the "TOP" mark face the piston top, and fit the oil ring side rail, 2nd compression ring and top compression ring in order with an expander.
7. Ensure that the piston rings can turn freely. The angle between the gaps A and B of the two compression rings should be 120° and away from the thrust side of the piston.
8. On both sides of the piston pin, the angle of the side rail gap C and spring gap D should be 30°.

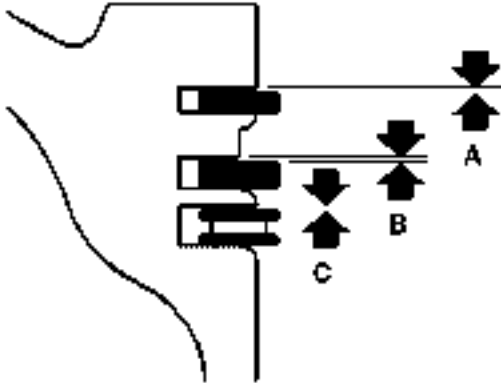


S111A406

9. Check the gaps between the new piston rings and ring grooves (Refer to "Parameter").

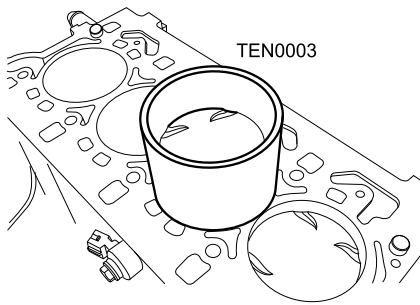
 **Parameter**

 Cylinder Head Assembly Refit

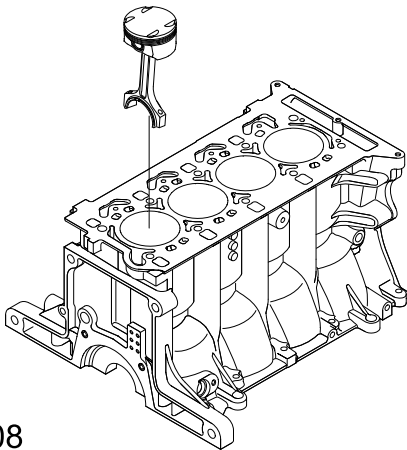


S111A407

10. Fit the piston connecting rod assembly into the special tool **TEN00003** from top to bottom, and align the guide tool with the cylinder bore. Make sure the arrow mark "-" on the top surface of the piston faces the front of the engine.



S111A409



S111A408

11. Firmly press the piston into the cylinder bore.

Tip: It is recommended to replace the piston connecting rod assembly as a set.

12. Fit the connecting rod cap and tighten the connecting rod bolts according to the torque chart.
13. Fit the cylinder head assembly.

Crankshaft Inspection

Removal

1. Remove the accessory drive belt.

 **Accessory Drive Belt Removal**

2. Remove the timing chain upper cover plate.

 **Timing Chain Upper Cover Plate Removal**

3. Remove the timing chain lower cover plate.

 **Timing Chain Lower Cover Plate Removal**

4. Remove the timing chain.

 **Timing Chain Removal**

5. Remove the cylinder head assembly.

 **Cylinder Head Assembly Removal**

6. Remove the engine flywheel or the torque converter drive plate.

 **Manual Flywheel Removal**

 **Torque Converter Drive Plate Removal**

7. Remove the crankshaft rear oil seal.

 **Crankshaft Rear Oil Seal Removal**

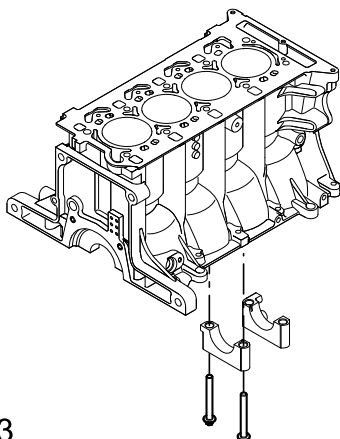
8. Remove the lower crank case assembly.

 **Lower Crank Case Removal**

9. Fit the crankshaft pulley bolt, and slightly turn it.
10. Mark the order of cylinders to which the connecting rods are fitted on the connecting rod big ends.

Caution: Keep the connecting rod big end caps, bearings and bolts in their original refit order.

11. Rotate the crankshaft pulley bolt to turn the crankshaft, setting each connecting rod bolt on the location easy to remove.
12. Remove the connecting rod bolts and the lower end cap of the connecting rod (the connecting rod big end cap); push the piston connecting rod assembly out of the cylinder bore gently.

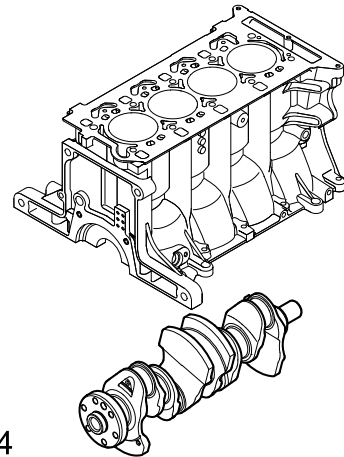


S111A403

13. Remove the connecting rod bearing from the connecting rod lower end cap (connecting rod big end

cap).

14. Unscrew the main bearing cap bolts, remove the main bearing cap, and remove the main bearing from the bearing seat.
15. Remove the crankshaft.

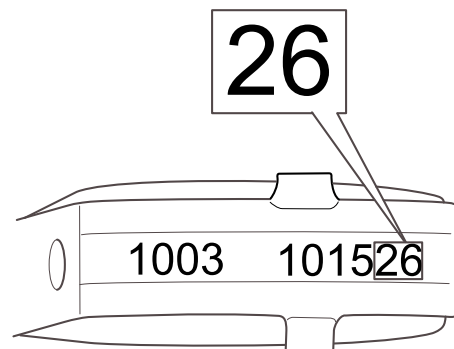


S111A404

16. Remove the 2 thrust washers from the fourth main bearing location.
17. Remove the main bearings from the cylinder block.
18. Remove the other half bearings from the connecting rods.

Refit

1. Clean the mating surfaces of the cylinder block and the bearing seats.
2. Clean the pins and the pin holes.
3. Clean the fitting positions for the bearings and thrust washers in the cylinder block.
4. Clean the fitting positions for the bearings on the bearing seats.
5. Clean the fitting positions for the bearings on the connecting rods and the caps.



Caution: The weight groupings of the piston connecting rod assemblies on the same engine should be same, fit them correctly. If the piston connecting rod assembly in the same group cannot be selected and fitted when servicing, replace all the piston connecting rod assemblies to ensure the piston connecting rod assembly weight is in the same group.

| Piston Connecting Rod Assembly | | Connecting Rod Assembly |
|--------------------------------|-----------|-------------------------|
| Aftermarket Grouping | Parts No. | Corresponding Group No. |
| A | 10050885 | 25 |
| B | 10050886 | 26 |
| C | 10050887 | 27 |
| D | 10050888 | 28 |
| E | 10050889 | 29 |
| F | 10050890 | 30 |
| G | 10050891 | 31 |
| H | 10050893 | 32 |

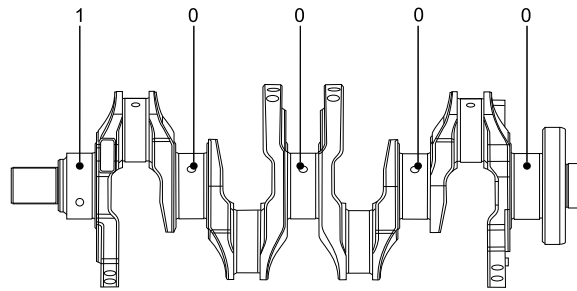
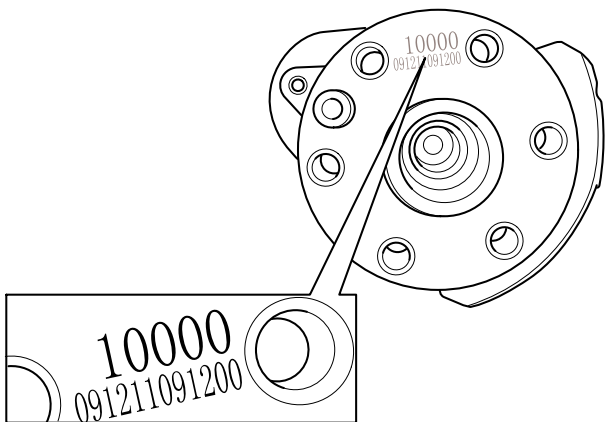
- Clean the crankshaft and check for any damage.
- Align the two connecting rod bearings with the bearing grooves, and press them into the connecting rod big end holes respectively. Make sure the end surfaces of the bearings are flush with the fracture surface of the connecting rod big end hole as much as possible.

Caution: The connecting rod bearings are not grouped.

Caution: Record the main bearing mark number on the front of the crankshaft.

- Record the main bearing mark number from the flange face on the rear end of the crankshaft, and the grouping rules are as follows:

| Journal Dia. | Grade |
|---------------------|-------|
| f 50.000 - f 49.993 | 0 |
| f 49.992 - f 49.984 | I |



- Check the diameters of the crankshaft main journals (Refer to "Parameter").

Parameter

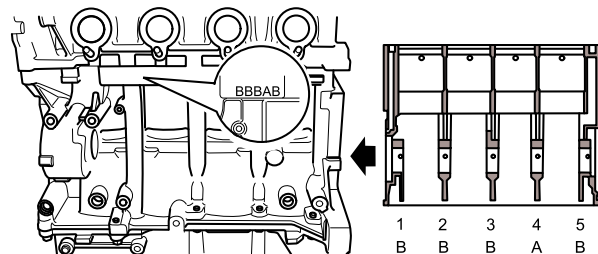
- Determine the proper main bearing to be fitted in accordance with the selected size and model (Refer to "Parameter").

Parameter

Caution: The bearings with oil grooves and oil holes are fitted in the main bearing holes of the cylinder block, and bearings without oil grooves and oil holes are fitted in the main bearing caps.

- The matching rule of the main bearing: the upper bearings are grouped according to the size of the cylinder block (A stands for blue and B stands for red).

| Grade | Diameter |
|-------|---------------------|
| A | 53.690 f ≤ 53.700 |
| B | 53.680 ≤ f ≤ 53.690 |



- Lower bearings are grouped by the crankshaft sizes (I stands for blue and 0 stands for red).
- Clean the sealing surfaces on the cylinder block and the bearing seats using a piece of cloth free of rough edges and appropriate solvent.

Tip: Please use SAIC Motor recommended cleaning solvent to remove the remaining sealer.

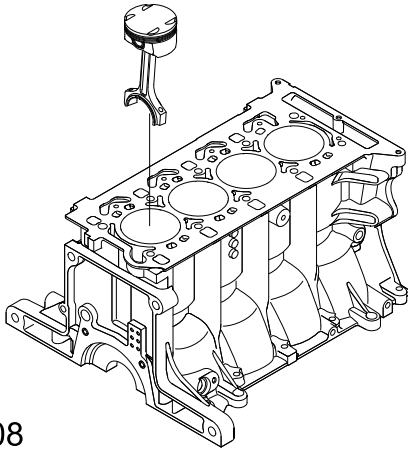
- Fit the selected crankshaft main bearings to the cylinder block and the bearing seats.
- Clean both sides of the cylinder block fourth main bearing and fit new thrust washers to them.

Tip: The oil groove surface of the thrust washer is the surface contacting with the crankshaft thrust surface, and never fit it reversely.

- Fit the crankshaft, apply a proper amount of lubricant to the main journals, then fit the main bearing caps.

Torque: $(20 \pm 2) \text{ Nm} + 90^\circ + (45 \pm 2)^\circ$

17. First apply oil to the connecting rod bearing and the crankshaft journal for connecting rod, then place the piston connecting rod assembly in the special tool **TEN00003** and press it into the cylinder. Fit the connecting rod big end cap. Torque: $(18 \pm 2) \text{ Nm} + (90 \pm 5)^\circ$.



S111A408

18. Fit the manual flywheel or the torque converter drive plate.

Flywheel Refit

Torque Converter Refit

19. Fit the crankshaft rear oil seal.

Crankshaft Rear Oil Seal Refit

20. Fit the cylinder head assembly.

Cylinder Head Assembly Refit

Crankshaft Rear Oil Seal

Removal

1. Disconnect the battery negative terminal.
2. Remove the transmission case assembly

Manual Transmission Case Removal

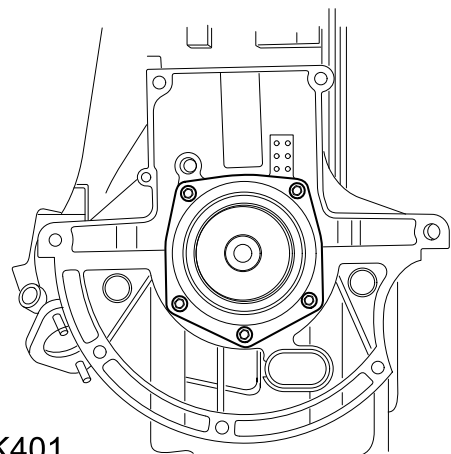
Automatic Transmission Removal

3. Remove the manual flywheel or the torque converter drive plate.

Manual Flywheel Removal

Torque Converter Drive Plate Removal

4. Loosen the 5 bolts around the oil seal.
5. Remove the oil seal and dispose of it.

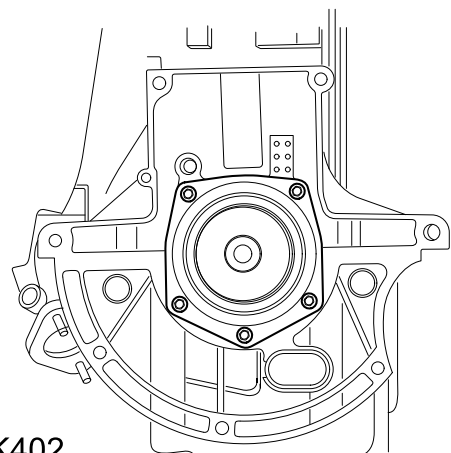


S111K401

Refit

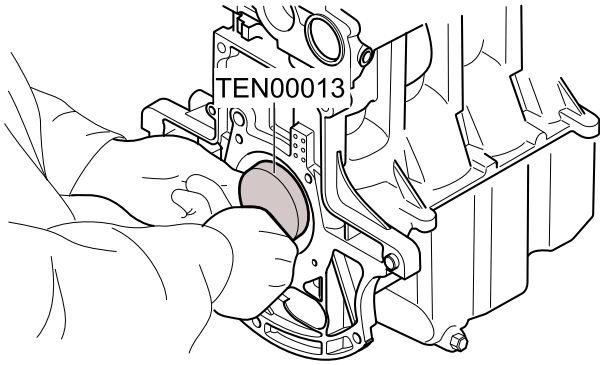
1. Clean the mating area for the oil seal of the crankshaft flange face journal to make sure there is no dirt.
2. Insert the crankshaft rear oil seal mounting guide sleeve special tool **TEN00013** into the rear end of crankshaft.
3. Apply clean oil to the oil seal lip.

Caution: Take care to avoid damaging the oil seal lip while fitting the oil seal.



S111K402

4. Slowly push the oil seal along the special tool **TEN00013** until the location pin on the oil seal in the pin hole of the cylinder block.



5. Slowly pull out the special tool while pressing the oil seal flange.
6. Tighten all the bolts and the tightening torque is **8-12 Nm**.
7. Fit the manual flywheel or the torque converter drive plate.

 **Flywheel Refit**

 **Torque Converter Refit**

8. Fit the transmission case assembly.

 **Manual Transmission Case Assembly Refit**

 **Automatic Transmission Case Assembly Refit**

9. Connect the battery negative terminal.

Oil Strainer

Removal

1. Disconnect the battery negative terminal.
2. Drain the engine oil.
3. Remove the accessory drive belt.

 **Accessory Drive Belt Removal**

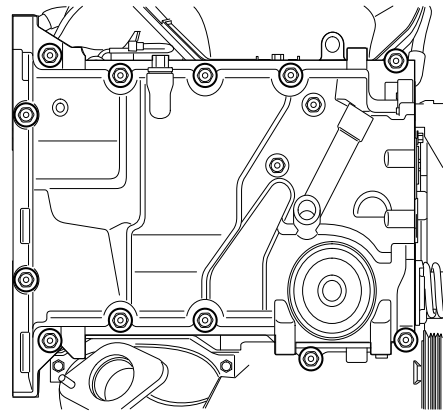
4. Remove the camshaft cover.

 **Camshaft Cover Removal**

5. Remove the timing chain lower cover plate.

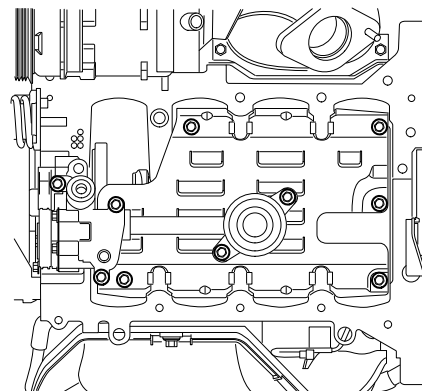
 **Timing Chain Lower Cover Plate Removal**

6. Remove the oil pump drive chain and drive sprocket.
7. Unscrew all the fastening bolts from the lower crank case to the cylinder block, and remove the lower crank case assembly.



S111I401

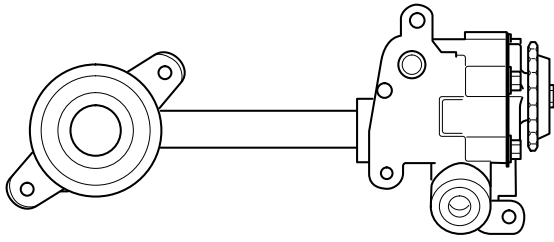
8. Unscrew all the bolts from the oil baffle to the lower crank case, and remove the oil baffle.



S111H401

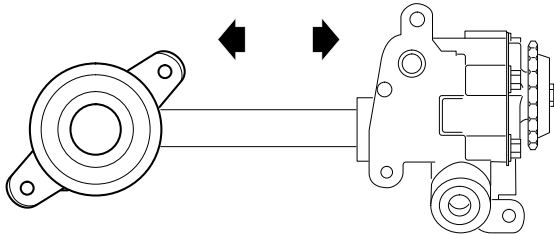
9. Remove the oil pump and oil strainer set bolts, and remove the oil pump with the oil strainer from the lower crank case.

11. Connect the battery negative terminal.



S111H402

10. Disengage the oil pump and oil strainer in the direction as shown in the illustration. Remove and dispose of the oil strainer seal ring.



S111H403

Refit

1. Clean the oil strainer and joint surface.
2. Lubricate a new O-ring with engine oil, and fit it to the oil strainer. Insert the oil strainer into a new oil pump in the opposite direction as shown in the above illustration.
3. Using the oil pump mounting bolts and oil strainer mounting bolts, tighten them to **8-12 Nm**.
4. Fit the oil baffle and the tightening torque is **8-12 Nm**.
5. Fit the lower crank case.

Lower Crank Case Refit

6. Fit the oil pump drive chain and drive sprocket.
7. Adjust the timing chain system.

Timing Chain Refit

8. Fit the timing chain lower cover plate.

Timing Chain Lower Cover Plate Refit

9. Fit the camshaft cover.

Camshaft Cover Refit

10. Fit the accessory drive belt.

Accessory Drive Belt Refit

Oil Pump

Removal

1. Disconnect the battery negative terminal.
2. Drain the engine oil.
3. Remove the accessory drive belt.

Accessory Drive Belt Removal

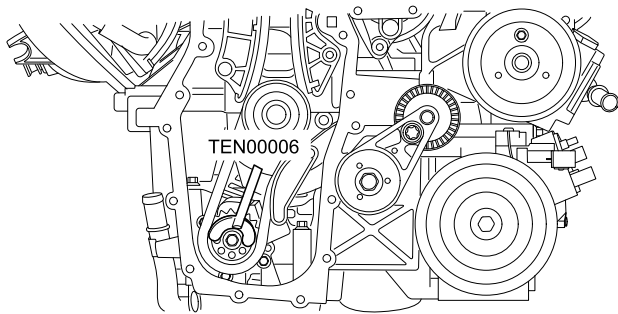
4. Remove the camshaft cover.

Camshaft Cover Removal

5. Remove the timing chain lower cover plate.

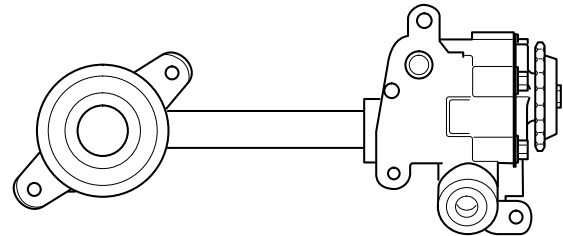
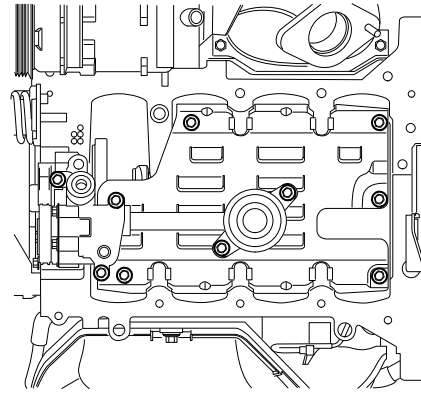
Timing Chain Lower Cover Plate Removal

6. Use the special tool **TEN00006** to secure the oil pump sprocket and remove it.



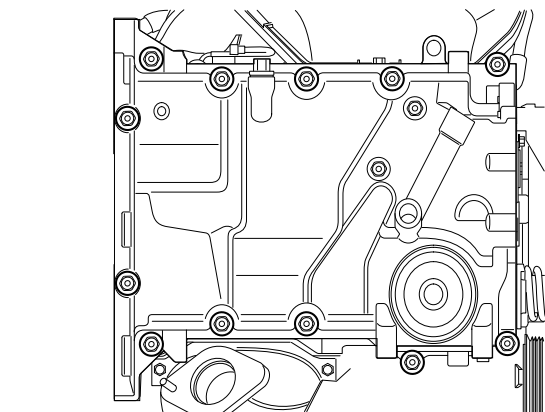
S111H401

10. Remove the oil pump and oil strainer set bolts, and remove the oil pump with the oil strainer from the lower crank case.



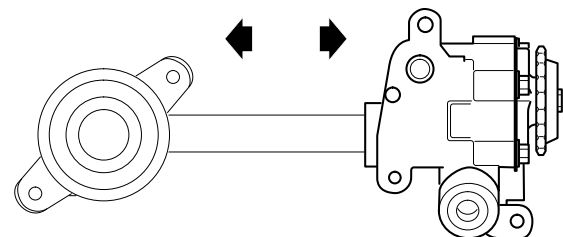
S111J424

7. Remove the oil pump drive chain.
8. Unscrew all the fastening bolts from the lower crank case to the cylinder block, and remove the lower crank case assembly.



S111H402

11. Disengage the oil pump and oil strainer in the direction as shown in the illustration. Remove and dispose of the oil strainer seal ring.



S111I401

9. Unscrew all the bolts from the oil baffle to the lower crank case, and remove the oil baffle.

S111H404

Refit

1. Clean the oil strainer and joint surface.
2. Lubricate a new O-ring with engine oil, and fit it to the oil strainer. Insert the oil strainer into a new oil pump in the opposite direction as shown in the above illustration.
3. Using the oil pump mounting bolts and oil strainer

mounting bolts, tighten them to **8-12 Nm**.

4. Fit the oil baffle.
5. Fit the lower crank case.

 **Lower Crank Case Refit**

6. Fit the oil pump drive chain and drive sprocket.
7. Adjust the timing chain system.

 **Timing Chain Refit**

8. Fit the timing chain lower cover plate.

 **Timing Chain Lower Cover Plate Refit**

9. Fit the camshaft cover.

 **Camshaft Cover Refit**

10. Fit the accessory drive belt.

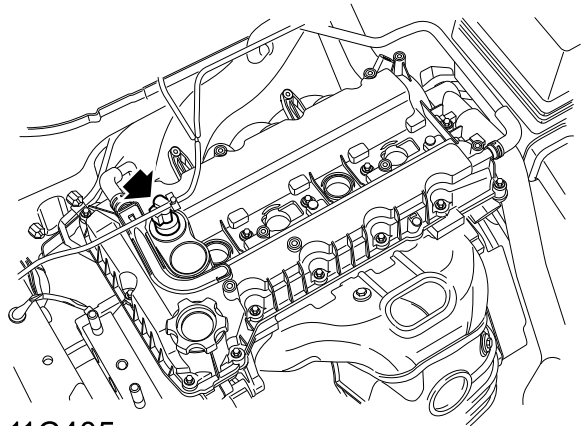
 **Accessory Drive Belt**

11. Connect the battery negative terminal.

Oil Control Valve

Removal

1. Disconnect the battery ground.
2. Disconnect the oil control valve connector.

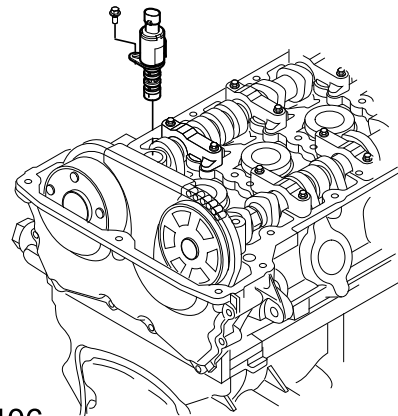


S111C405

3. Remove the camshaft cover.

 **Camshaft Cover Removal**

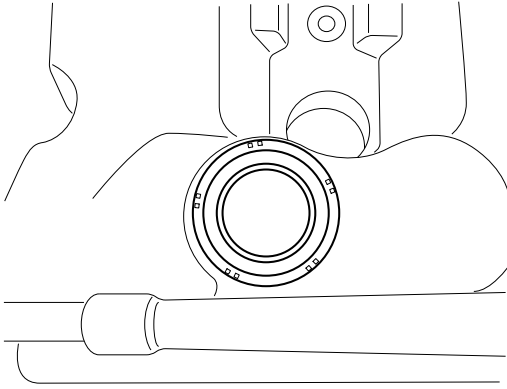
4. Loosen the bolt securing the oil control valve and remove the oil control valve.



S111C406

Refit

1. Fit a new oil control valve to the front bearing cap, tighten it with the bolt, and the tightening torque is **5-7 Nm**.
2. Check the oil seal of the oil control valve. If there is any sign of oil leakage, deterioration or crack, replace it with a new one. Fit the oil seal of the oil control valve to the camshaft cover.

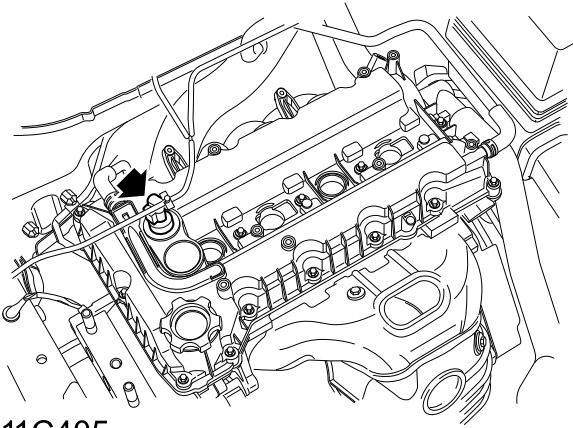


S111C407

3. Fit the camshaft cover.

Camshaft Cover Refit

4. Connect the oil control valve connector.



S111C405

5. Connect the battery ground.

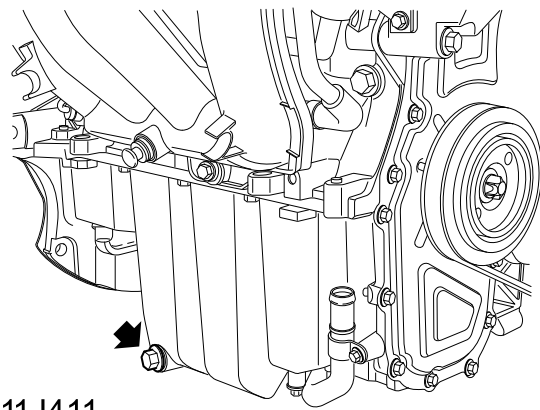
Engine Oil Filter

Removal

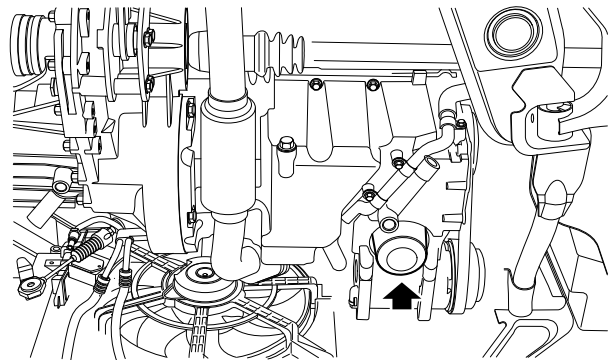
1. Raise the vehicle with a lift.
2. Put a proper container under the drain plug of the engine oil pan, remove the plug and dispose of the seal washer. Drain the oil.

Warning: Take extra care when draining the engine oil, as the oil may be very hot.

Warning: Avoid prolonged or repeated contact between skin and used engine oil. Used engine oil may contain harmful contaminants which may cause skin cancer or other serious skin inflammations.



S111J411

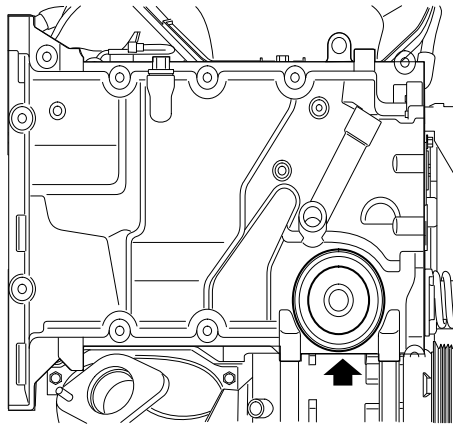


S111H405

3. Clean the area around the filter top, and put a proper container under the filter to collect the oil that may spill.
4. Turn the filter counterclockwise to remove it, and dispose of it.

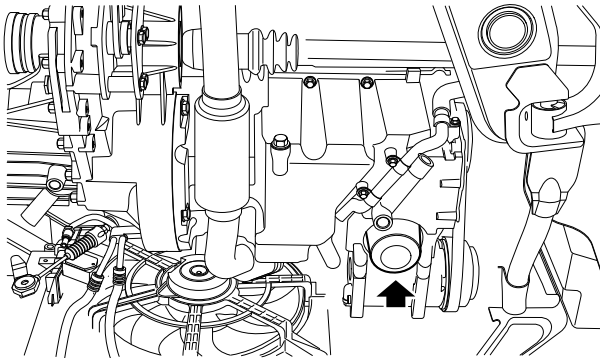
Refit

1. Clean the mating surface on the filter top.



S111H406

2. Lubricate the seal ring of the filter with clean engine oil.
3. Fit a new filter and tighten it to **16–18 Nm**.



S111H405

4. Clean the oil drain plug and fit a new seal washer.
5. Fit the drain plug and tighten it to **35-40 Nm**.
6. Remove the engine oil filler cap and fill oil in the engine to the correct level.

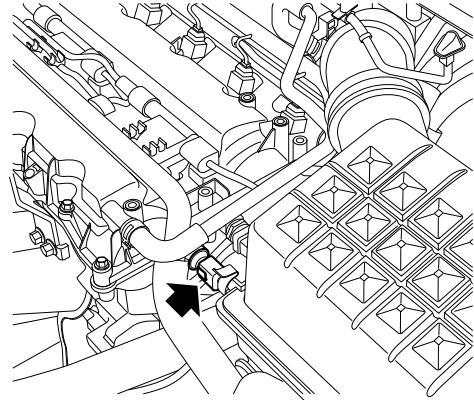
 **Lubricant Refill**

7. Fit the oil filler cap.
8. Lower the vehicle.
9. Start and run the engine until the oil pressure warning light goes off.
10. Check the engine oil level again after stopping the engine.
11. Check for any sign of oil leakage.

Engine Oil Pressure Inspection

Inspection

1. Disconnect the battery negative terminal.
2. Disconnect the oil pressure switch connector.
3. Remove the oil pressure switch.



S113B405

4. Remove the seal ring from the oil pressure switch, and fit it to the oil pressure gauge connector.
5. Fit the oil pressure gauge connector to the original position of the oil pressure switch and tighten it.
6. Connect the oil pressure gauge **T10001** and **T10002**, and tighten the connector.
7. Check the engine oil, and add oil if necessary.
8. Start and run the engine until it reaches the normal operating temperature.
9. When the engine operates at 3500 rpm, observe the reading of the oil pressure gauge (Refer to "Parameter").

 **Parameter**

10. Turn off the engine, disconnect the pressure gauge connector and remove the gauge.
11. Unscrew the connector.
12. Wipe up the spilled oil.
13. Fit the oil pressure switch.
14. Connect the oil pressure switch connector.
15. Connect the battery negative terminal.

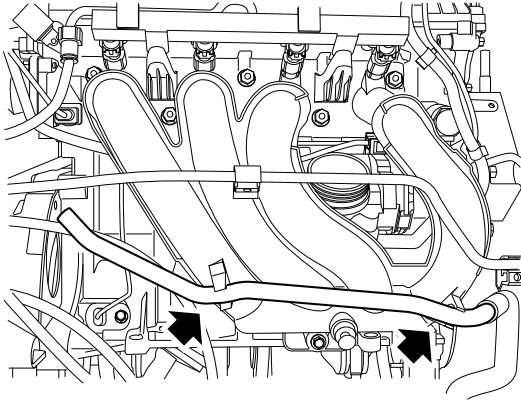
Intake Manifold Gasket

Removal

1. Disconnect the battery negative terminal.
2. Remove the intake pipe assembly.

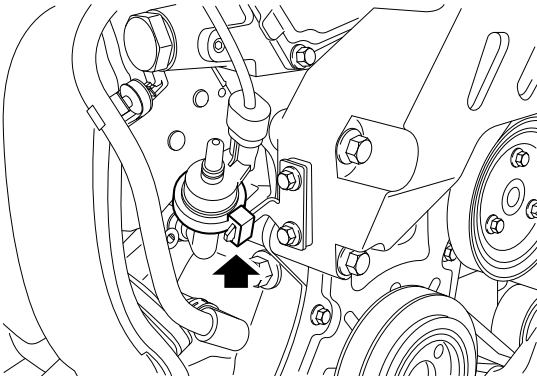
Intake Pipe Assembly Removal

3. Disconnect the heater return pipe from the intake manifold clamps.



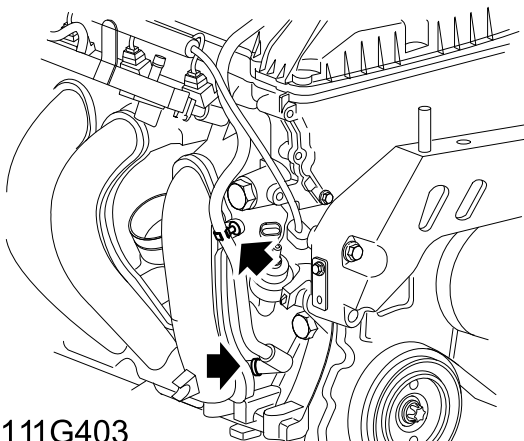
S111G401

4. Disengage the clamp and disconnect the canister solenoid valve hose from the intake manifold.



S111G402

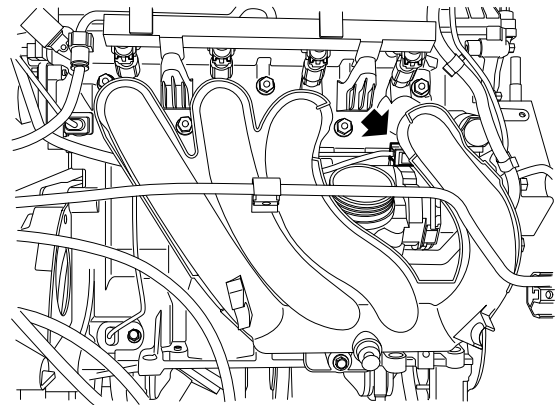
5. Pull out the C-tube clamp fitted on the intake manifold. Disengage the clamp and disconnect the partial load breather tube clamp from the intake manifold.



S111G403

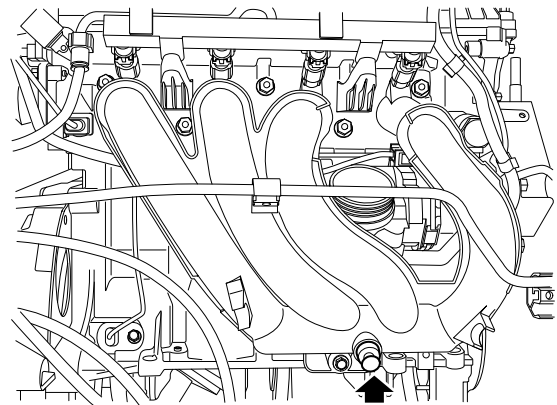
6. Disconnect the connector from the electronic throttle

sensor.



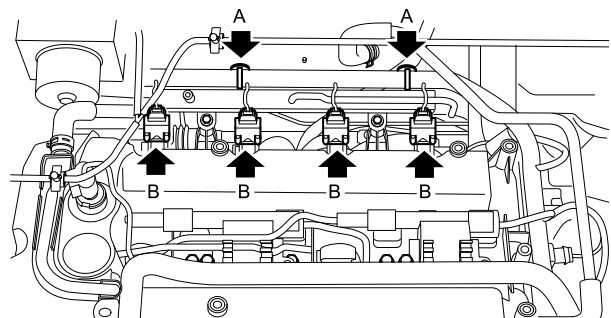
S111G404

7. Press the plastic ring, and disconnect the brake booster tube from the intake manifold.

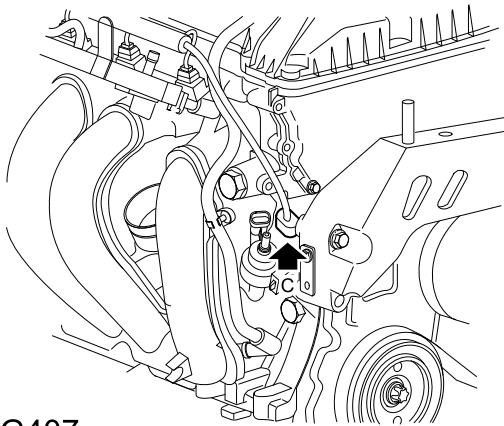


S111G405

8. Pull out the wire snap fit A from the fuel rail bracket, and disconnect the injector connector B and canister solenoid valve connector C.

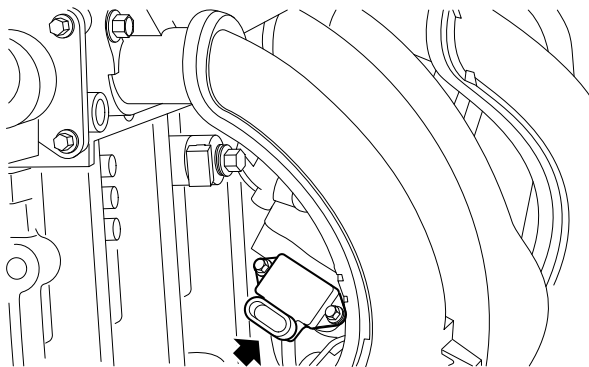


S111G406



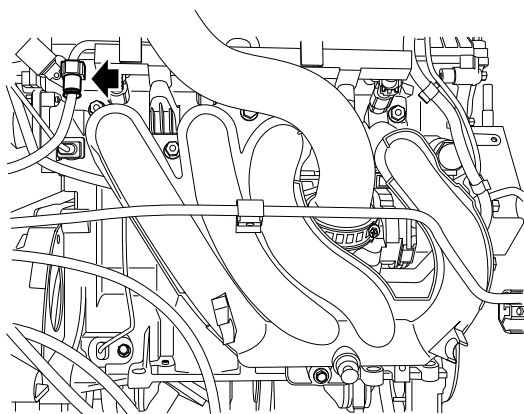
S111G407

9. Disconnect the connector from the intake manifold absolute pressure temperature sensor.



S111G408

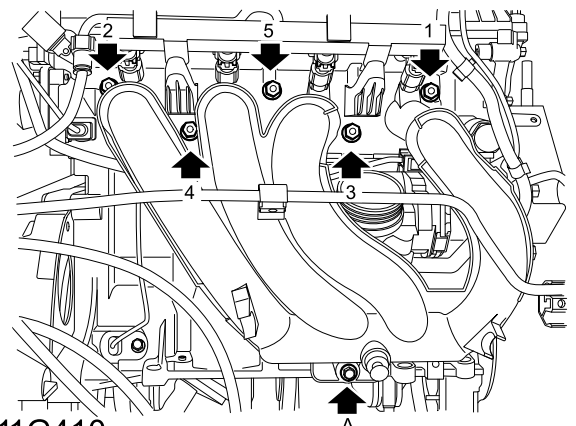
10. Secure a piece of cloth with high absorbency under the fuel guide rail.
11. Disconnect the fuel inlet tube from the fuel rail.



S111G409

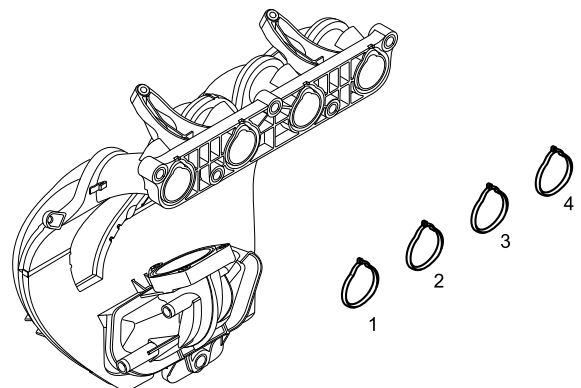
Caution: Plug the disconnected unions to prevent contamination entering.

12. First remove the bolt A connecting the intake manifold and cylinder block, then remove the 5 nuts securing the intake manifold to the cylinder head in the order as shown in the illustration.



S111G410

13. Remove the intake manifold, remove and dispose of the 4 seal washers.



S111G411

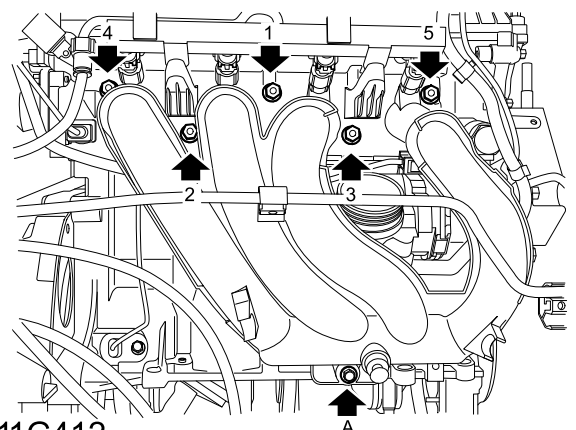
Refit

1. Make sure the mating surface is clean and the metal inserts has been fitted to the intake manifold bolts and bolt holes.

2. Fit new washers onto the intake manifold.

Tip: Be careful of the error proofing design on the washer.

3. Tighten 5 nuts in the order as shown, and secure the mounting bolt A from the intake manifold to the cylinder block.



S111G412

4. Remove the plugs from the fuel hose and fuel rail.
5. Secure the fuel inlet tube onto the fuel rail.

6. Connect the TMAPTMAP sensor connector.
7. Connect the injector connectors, fit the wire snap fit to the fuel rail bracket hole and connect the canister solenoid valve connector.
8. Insert the brake booster tube into the quick joint of the intake manifold.
9. Connect the electronic throttle sensor connector.
10. Connect the partial load breather tube to the intake manifold, clamp it with the clamp and insert the C-tube clamp into the intake manifold mounting hole.
11. Connect the canister solenoid valve hose to the intake manifold and clamp it with the clamp.
12. Secure the heater return pipe on the intake manifold clamp.
13. Fit the intake pipe assembly.

Intake Pipe Refit

14. Connect the battery ground.

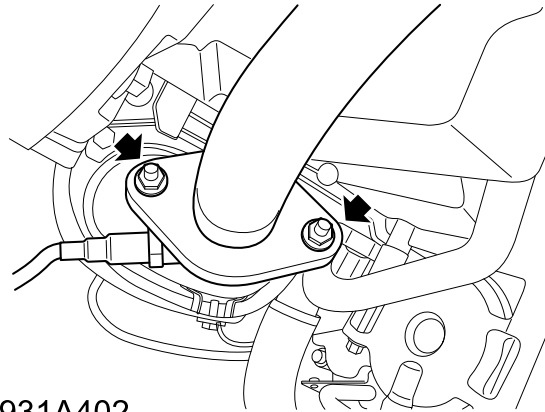
Exhaust Manifold Gasket

Removal

1. Disconnect the battery negative terminal.
2. Remove the generator.

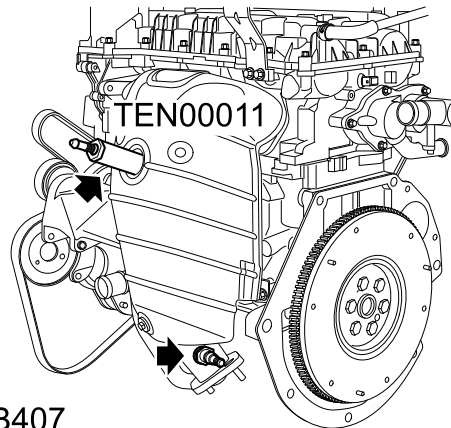
Generator Removal

3. Remove the bolts connecting the exhaust manifold and front exhaust pipe assembly.



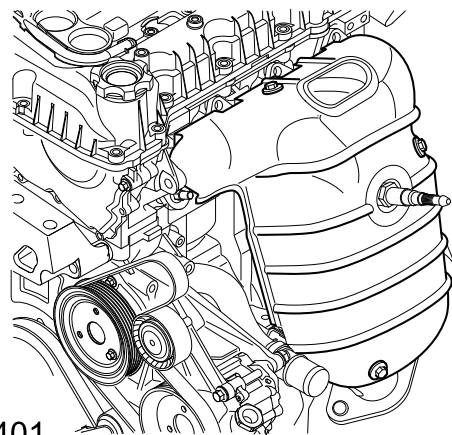
S931A402

4. Disconnect the oxygen sensor connectors.



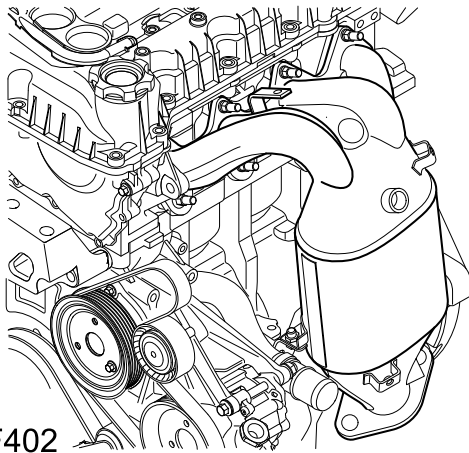
S113B407

5. Remove the exhaust manifold housing.



S111F401

6. Remove the exhaust manifold.

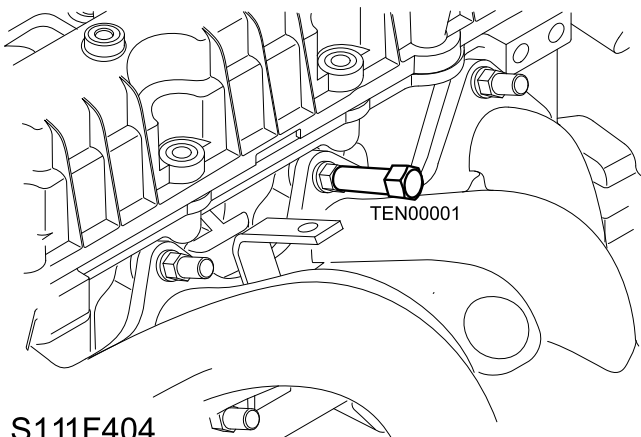


S111F402

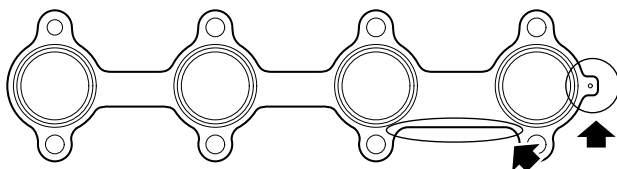
7. Remove the exhaust manifold gasket from the mating surfaces of the cylinder head and exhaust manifold, and dispose of it.

Refit

1. Clean the mating surfaces of the cylinder head and exhaust manifold to make sure it is clean and free of foreign matter.
2. Use the special stud bolt replacer **TEN00001** to fit the stud bolts.

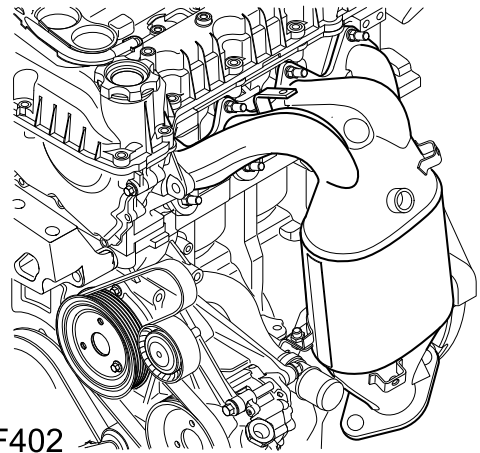


S111F404



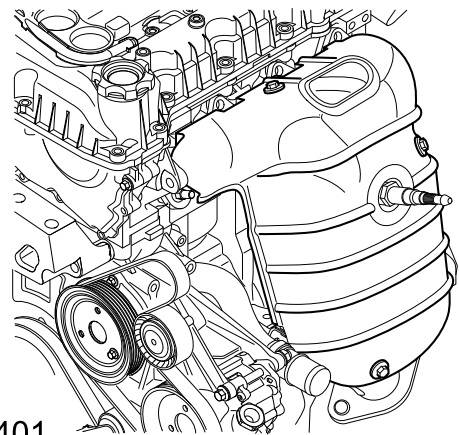
S111F403

3. Correctly fit the exhaust manifold gasket to the stud bolts of the cylinder head in the direction determined by the error proofing design.
4. Fit the exhaust manifold.



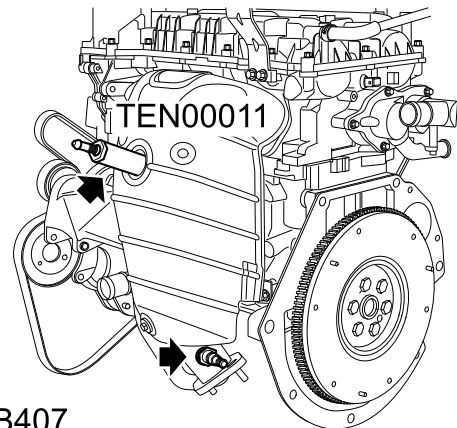
S111F401

5. Fit the exhaust manifold housing.



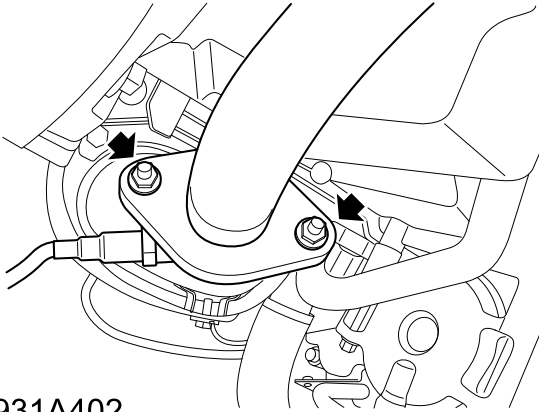
S111F401

6. Connect the oxygen sensor connectors.



S113B407

7. Fit the bolts connecting the exhaust manifold and front exhaust pipe assembly.



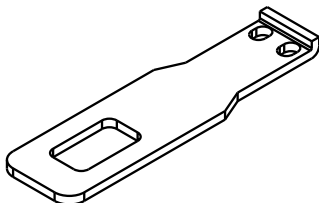
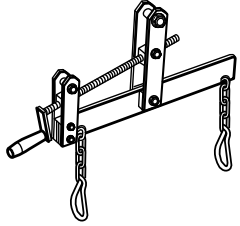
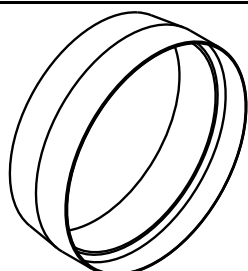
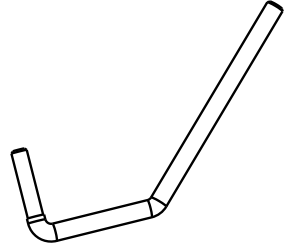
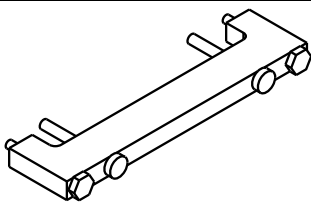
S931A402

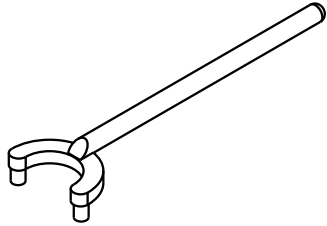
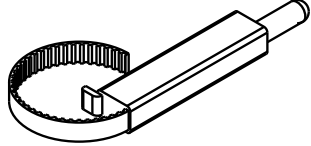
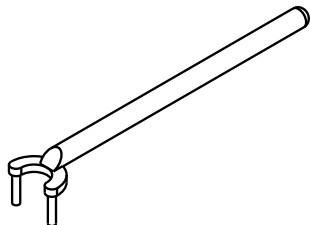
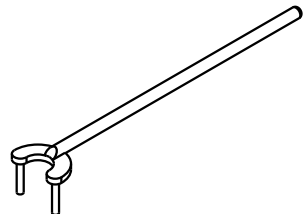
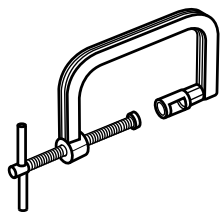
8. Fit the generator.

 **Generator Refit**

9. Connect the battery negative terminal.

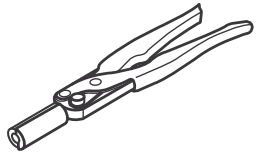
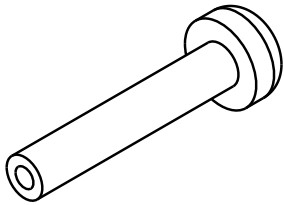
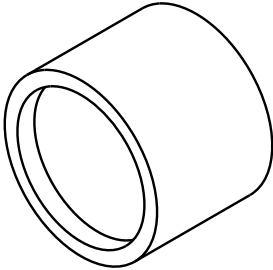
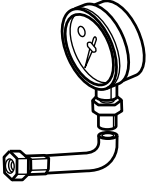
Special Tools

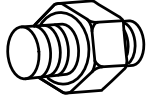
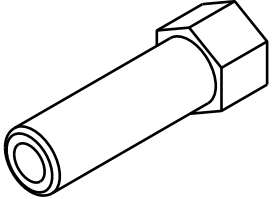
| Tool Number | Description | Picture |
|-------------|---|---|
| TEN00012 | Engine Hanger |  TEN00012 |
| T10007 | Engine Service Lift Bracket |  T10007 |
| TEN00013 | Crankshaft Rear Oil Seal Refit Guide Sleeve |  TEN00013 |
| TEN00002 | Flywheel Timing Location Pin |  TEN00002 |
| TEN00004 | Camshaft Timing Tool |  TEN00004 |

| Tool Number | Description | Picture |
|-------------|--------------------------------|---|
| TEN00008 | Crankshaft Pulley Holding Tool |  TEN00008 |
| TEN00009 | Pulley Replacer Holding Tool |  TEN00009 |
| TEN00006 | Oil Pump Sprocket Holding Tool |  TEN00006 |
| TEN00005 | Camshaft Sprocket Locking Tool |  TEN00005 |
| T10005 | Valve Spring Compressor |  T10005 |

Engine

Engine Mechanical

| Tool Number | Description | Picture |
|-------------|-------------------------------|--|
| T10006 | Valve Oil Seal Removal Pliers |  <p>T10006</p> |
| TEN00014 | Valve Oil Seal Replacer |  <p>TEN00014</p> |
| TEN00003 | Camshaft Timing Tool |  <p>TEN00003</p> |
| T10001 | Engine Oil Pressure Gauge |  <p>T10001</p> |

| Tool Number | Description | Picture |
|-------------|-----------------------------------|---|
| T10002 | Engine Oil Pressure Gauge Adaptor |  <p>T10002</p> |
| TEN00001 | M8 Stud Bolt Replacer |  <p>TEN00001</p> |

Engine Cooling System

Specifications

Torque

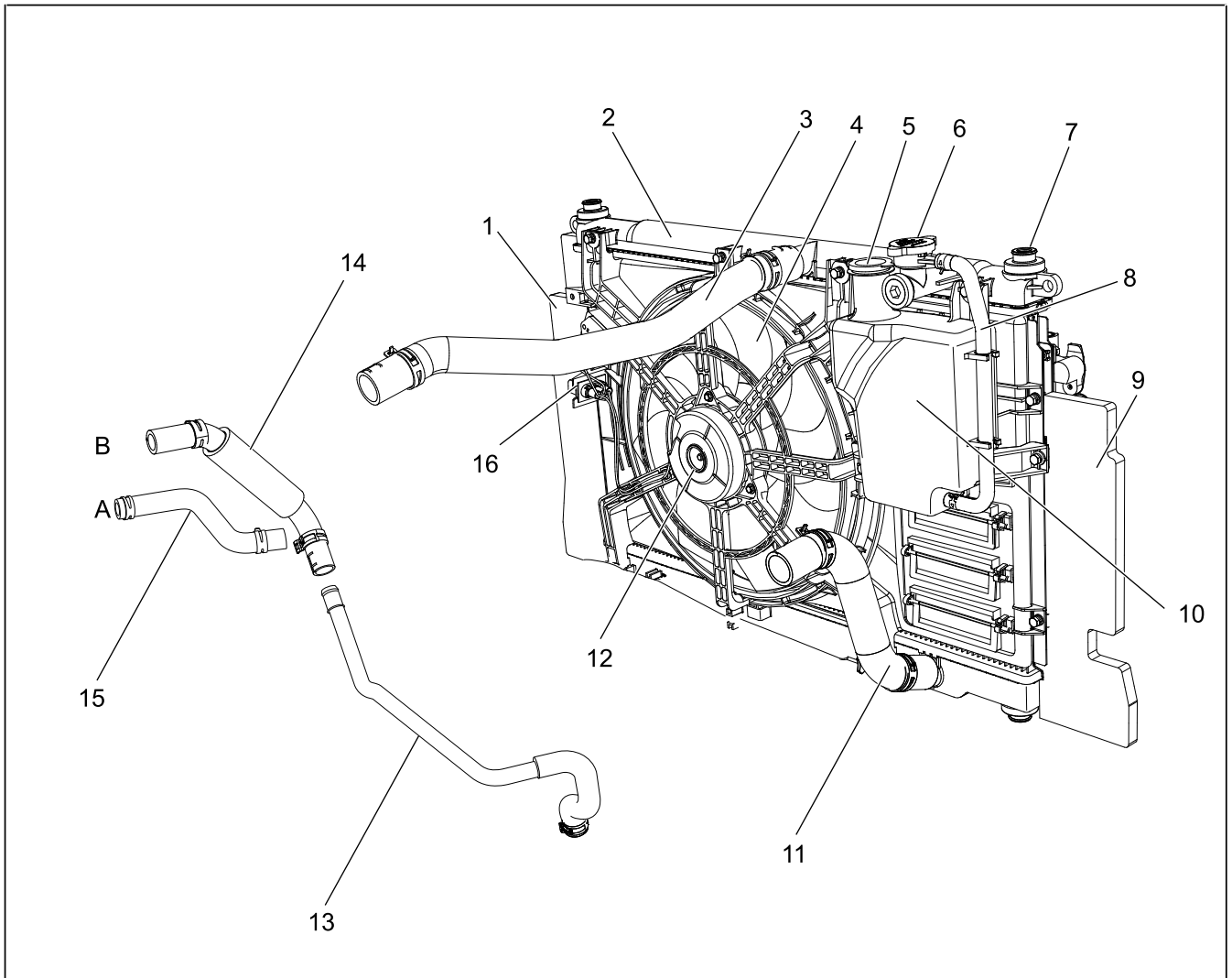
| Description | Value |
|---|------------|
| Screw - Expansion Tank Assembly Tightening | 5.5–7.5 Nm |
| Screw - Cooling Fan Assembly Tightening | 5.5–7.5 Nm |
| Screw - Governor Resistor Tightening | 5.5–7.5 Nm |
| Screw - Air Conditioner Condenser Tightening | 5.5–7.5 Nm |
| Bolt - Oil Cooling Pipe to Oil Cooler | 35-40 Nm |
| Screw - Main Oil Cooler Assembly Bracket to Automatic Transmission Case | 7–10 Nm |
| Bolt - Thermostat Housing Assembly to Cylinder Head | 8–12 Nm |
| Bolt - Water Pump to Cylinder Block | 8–12 Nm |
| Bolt - Water Pump Pulley to Pulley Hub | 9–11 Nm |

Parameter

| | |
|---|---|
| Coolant Volume: | 7.3 L |
| Cooling Fan: | Temperature Control Power Axial-Flow Type |
| Switch Point of the Cooling Fan - For the air conditioner System | |
| High Speed: | 1.77 Mpa |
| <ul style="list-style-type: none"> • ON • OFF | 1.37 Mpa |
| Switch Point of the Cooling Fan - For cooling when the engine runs normally | |
| ON: | 100 °C |
| <ul style="list-style-type: none"> • Low Speed • High Speed | 112 °C |
| OFF: | 94 °C |
| <ul style="list-style-type: none"> • Low Speed • High Speed | 106 °C |
| Switch Point of the Cooling Fan - For cooling after the engine stops | |
| ON: | 110 °C |
| <ul style="list-style-type: none"> • Low Speed • High Speed | 104 °C |
| OFF: | 106 °C |
| <ul style="list-style-type: none"> • Low Speed • High Speed | 100 °C |
| Duration | 30 s at most |
| Radiator | Straight Flow Type |
| Cooling Water Pump | Mechanical, Radial-Flow Impeller |

| | |
|---|---|
| Drive Ratio of the Cooling Water Pump | 1 : 1 |
| Double Thermostat | Wax-Type Element |
| Primary Thermostat: <ul style="list-style-type: none"> • Originally Open • Completely Open • Close Secondary Thermostat: <ul style="list-style-type: none"> • Originally Open • Completely Open • Close | 80±2 °C 92 °C ≤80±2 °C 88±2 °C 102 °C ≤88±2 °C |
| The Relief Valve of the Tank Pressure Cover <ul style="list-style-type: none"> • High-Voltage Open • Low-Voltage Open | 93-123 KPa 0-9.8 KPa |

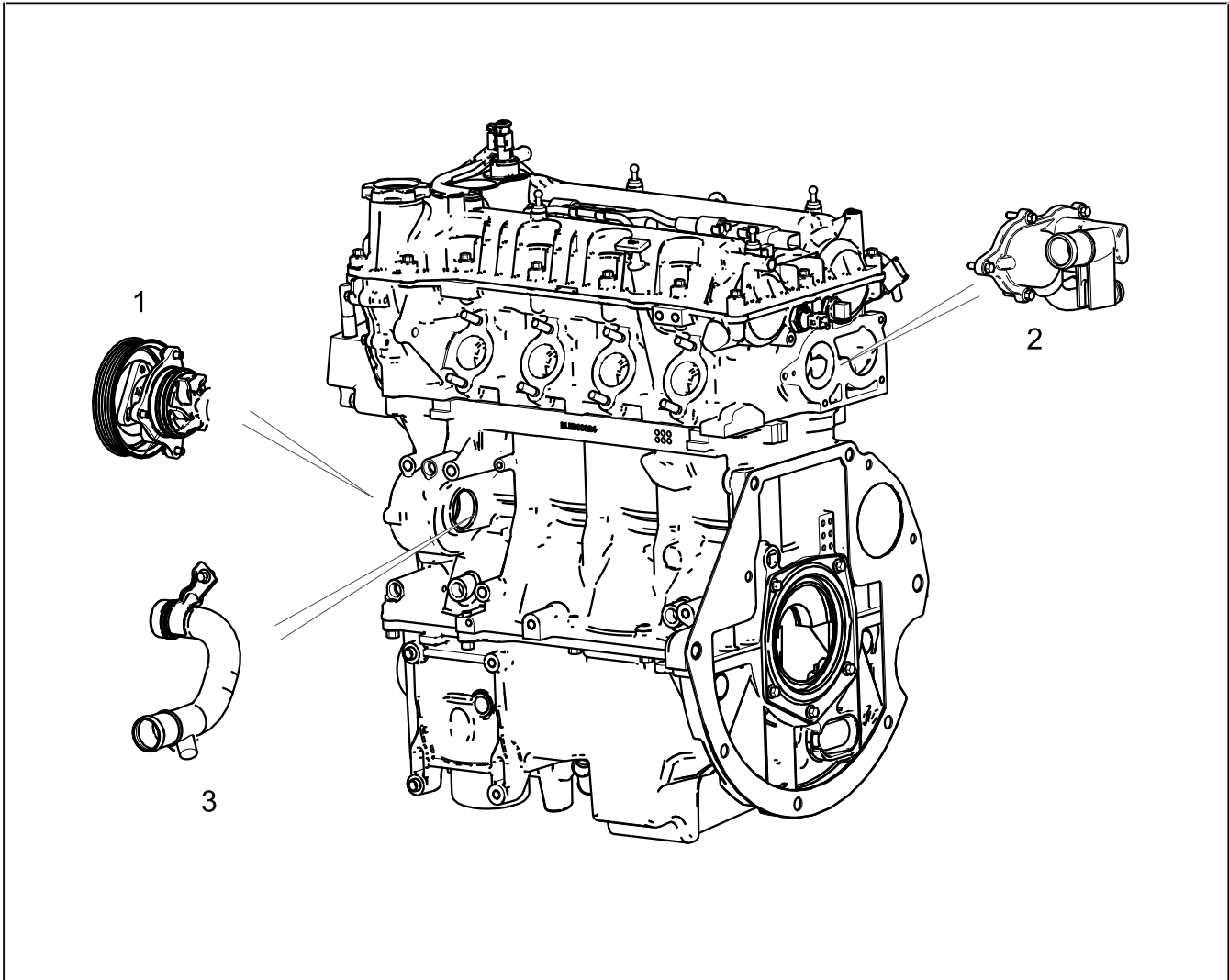
Description and Operation
System Component Layout
Cooling Module and Hose



A = Heater Core Water Inlet; B = Heater Core Water Outlet

- | | |
|---------------------------------|------------------------------------|
| 1. Cooling Module Seal Sponge | 9. Cooling Module Seal Sponge |
| 2. Radiator | 10. Expansion Tank |
| 3. Radiator Water Hose Inlet | 11. Radiator Water Hose Outlet |
| 4. Cooling Fan Assembly | 12. Cooling Fan Motor |
| 5. Expansion Tank Cover | 13. Oil Cooler Water Hose Inlet |
| 6. Radiator Pressure Seal Cover | 14. Heater Core Water Hose Outlet |
| 7. Radiator Cushion Plate | 15. Heater Core Water Hose Inlet |
| 8. Radiator Overflow Hose | 16. Cooling Fan Low Speed Resistor |

Water Pump and Thermostat



- 1. Water Pump
- 2. Thermostat Assembly

- 3. Water Pipe

Description

General Description

Coolant cycles in the engine, radiator and heater core circuit. It is a mixture of 50% water and 50% organic acid technique (OAT), in order to keep the engine at optimum operating temperature in different environment and engine operating conditions.

Caution: *The engine coolant damages the painted surface. If the coolant overflows, immediately clean it off and wash with water.*

Periodic replace the coolant to maintain the optimal efficiency and anti-corrosion performance.

Cooling System Components

Coolant Pump

Coolant is circulated by driving the coolant pump, which is fitted on the upper rear part of the engine crankcase drive end, sealed on the cylinder block with an O-ring and driven by the camshaft timing pulley.

Coolant Hose

The coolant hose connects each component of the cooling system and the coolant runs among each component through the coolant hose. The coolant hose is secured on each component with spring clamp.

Radiator Pressure Seal Cover

The radiator pressure seal cover is fitted on the top of the radiator, and the pressure limiting valve and the vacuum valve are on the pressure seal cover. When the system pressure reaches 93-123 kPa, the pressure limiting valve opens to discharge the system pressure; when the system pressure reaches 0-9.8 kPa, the vacuum valve opens to allow the outside to fill the system with fluid. Thus, the cooling system runs in a certain pressure range.

Expansion Tank

The expansion tank is fitted on the right of the cooling module cooling fan, with an overflow/return hose connected from the bottom of the expansion tank to the top of the radiator. When the coolant expands after being warmed up, the extra coolant in the cooling system runs back to the expansion tank through the overflow/return hose; when the coolant in the cooling

system is insufficient, the coolant in the expansion tank returns to the cooling system through the overflow/return hose.

Thermostat

The thermostat is a wax-type element with the characteristic of pressure discharge. The thermostat is located in the engine upper thermostat housing.

When the coolant temperature is low, the wax-type element of the thermostat is in a solid state, the thermostat valve turns off with the effect of the spring, then the cooling system stays in the small circulation, ie. the coolant cannot enter the radiator to circulate, but it can run to the heater core through the by-pass circuit. When the coolant temperature goes up, the wax-type element begins to melt down to the liquid state, its volume also increases, and the thermostat valve gradually opens with the effect of the push rod, then the cooling system stays in the large circulation, and when the thermostat is fully open, all the coolant runs through the radiator. The thermostat keeps the coolant at optimum engine operating temperature.

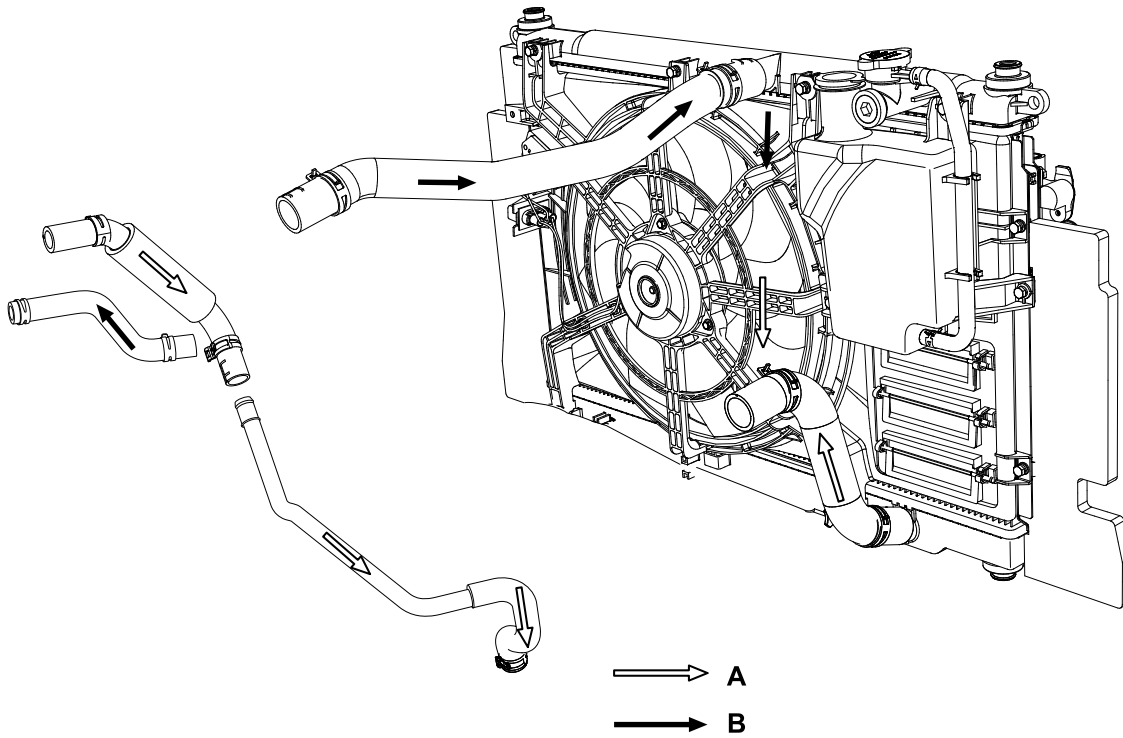
Radiator and Cooling Fan

The radiator is a straight flow aluminum radiator with a tank (For the automatic transmission model, the automatic transmission oil cooler locates in the lower tank of the radiator. The cooling hose connected to the transmission is connected to the sleeve of the transmission oil cooler with nuts). The cooling fan assembly and the air conditioner (A/C) condenser are fitted on the radiator.

The top of the radiator is secured on the modular front end panel with the rubber bush, and the lower part is fitted on the radiator bracket with the rubber bush. The seal sponge is fitted on both sides of the radiator, to direct the air flow through the radiator.

The cooling fan assembly is fitted on the back of the radiator. The cooling fan cools the radiator with the sucked air passing through the radiator. The vent holes provided on one side of the fan shroud allow more air flows to pass through the radiator in use with the cooling fan when driving at a high speed. The cooling fan low speed resistor is fitted on the left of the radiator.

Operation
Coolant Flow



A = Cold; B = Hot

Based on heat conduction theory, the cooling system transmits the heat from the engine pack to the coolant. When the engine is in lower temperature, the coolant pump circulates the coolant among the engine body, cylinder head and passenger compartment heater core. Keep the thermostat closed to prevent the coolant flowing through the radiator, and allow a small amount of coolant to pass by to avoid the accumulated pressure too high. When the engine reaches the normal operating temperature, the thermostat opens so that the cold coolant flows from the hose at the bottom of the radiator into the cylinder block and the hot coolant flows into the radiator. The cold and hot coolant is balanced to maintain an optimal engine temperature. When the thermostat is fully open, all of the coolant flows through the radiator. The extra coolant generated by heat expansion flows through overflow hose on the top of the radiator and then returns to the expansion tank. The expansion tank eliminates the gas in the coolant simultaneously. The radiator pressure seal cover with pressure limiting valve and vacuum valve separates the cooling system from the ambient atmosphere. Therefore, the coolant expands and the pressure of the cooling system increases as the temperature rises. The increasing pressure increases the coolant boiling point, thus making the engine run at a higher and more efficient operating temperature without the risk of coolant boiling. The pressure boost of the cooling system is limited, so a pressure discharge valve is fitted on the expansion tank cover. So the excessive pressure in the cooling system

can be discharged when the system exceeds the maximum acceptable operating pressure.

Cooling Fan Control Strategy

The cooling fan will operate at a high or low speed, and use **ECM** and relay unit to effect control. **ECM** uses the information from the **ECT** sensor, **BCM** and air conditioning pressure switch to control the fan speed, thus restricting the engine coolant temperature.

During the normal operation, the fan will operate in the following temperature conditions:

| Cooling Fan Condition | Low Speed | High Speed |
|-----------------------|-----------|------------|
| ON | 100 °C | 112 °C |
| OFF | 94 °C | 106 °C |

When the air conditioning system is operating, the fan will operate in the following pressure conditions:

| Cooling Fan Condition | High Speed |
|-----------------------|------------|
| ON | 1.77 Mpa |
| OFF | 1.37 Mpa |

The fan control strategy includes the engine idling adjustment which can compensate for the additional load generated after the fan is turned on. After the ignition key is removed:

| Cooling Fan Condition | Low Speed | High Speed |
|-----------------------|-----------|------------|
| ON | 104 °C | 110 °C |
| OFF | 100 °C | 106 °C |

The cooling fan will operate for 30 seconds to make the engine obtain additional cooling in hotter environment. When the **ECT** is malfunctioning, the fan will operate at a low speed.

Cooling Fan Relay Unit

The fan control relay unit is connected to the **ECM** with two wires, and another wire works as the earth lead of the internal relay winding. The 12 V power supply is provided to the cooling fan relay through the No.13 fuse in the engine bay fuse box. The fan motor is driven by the relay via the output of the No.13 fusible link in engine bay fuse box. The power is provided by the relay R6 when the fan operates at a low speed, and the power is provided by the relay R7 when the fan operates at a high speed.

The cooling fan relay may be malfunctioning in the following conditions:

- Open in High Speed Relay Coil
- Short in High Speed Relay Coil
- High Speed Relay Contact Point Resistance High
- Open in High Speed Relay Contact Point
- Open in Low Speed Relay Coil
- Short in Low Speed Relay Coil
- Low Speed Relay Contact Point Resistance High
- Open in External Wire
- External Wire Short to the 12 V Power Supply
- External Wire Short to the Ground
- External Wire Resistance High

Warning: Keep away from the cooling fan. The fan may start automatically without warning, even after the engine is turned off.

Service Procedures

Coolant - Drain and Refill

Caution: The engine coolant damages the painted surface. If the coolant overflows, immediately clean it off and wash with water.

Drain

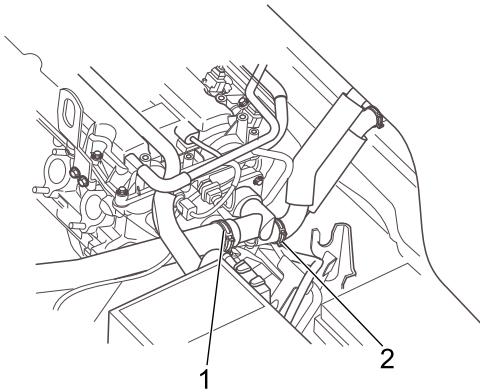
1. Remove the bottom wind deflector panel.

Bottom Wind Deflector Panel Removal

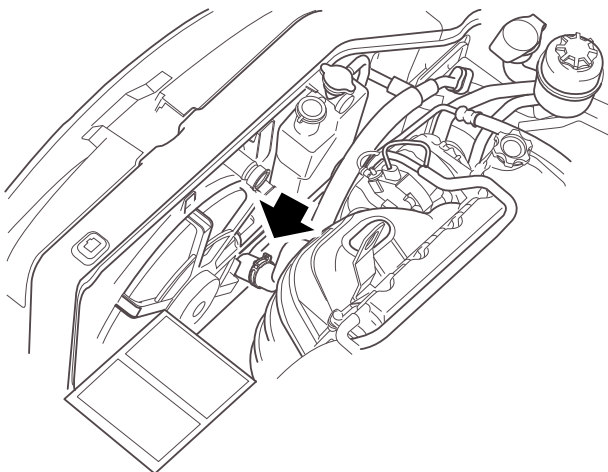
2. Remove the pressure seal cover.

Warning: Since injury such as scalding could be caused by escaping steam or coolant, DO NOT open the expansion tank cap while the cooling system is still hot.

3. Set the appropriate container to collect the coolant.
4. Detach the clips and disconnect the heater core return hose from back of the cylinder block.



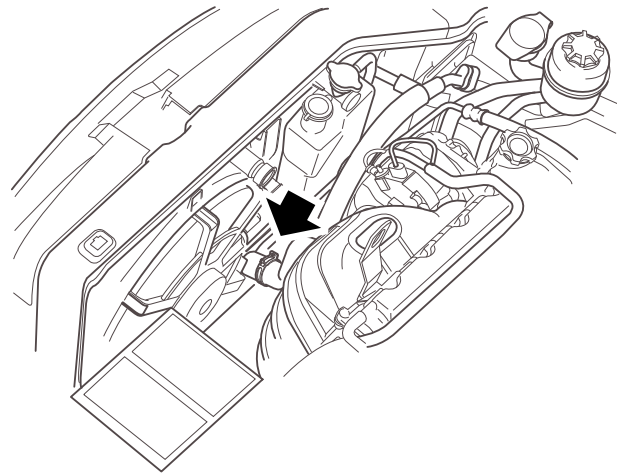
5. Detach the clips and disconnect the bottom hose from the radiator.



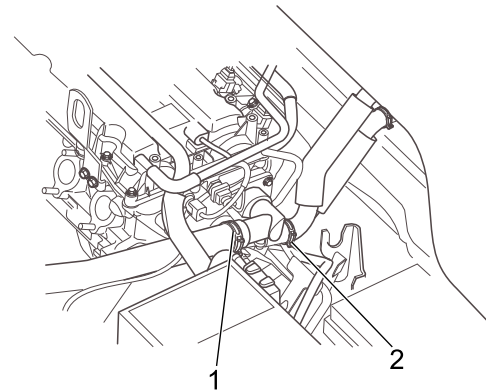
6. Drain the cooling system.

Refill

1. Connect the bottom hose to the radiator and hold it with clips.



2. Connect the heater core return hose to the cylinder block and hold it with clip (2).



3. Prepare the coolant with specified density.

Fluid

4. Loosen the tank pressure cover and fill it until the coolant reaches the top of the tank and keeps still.
5. Open the expansion tank cover and continue to fill it until the coolant reaches between MIN and MAX.
6. Make sure that the air conditioner is off.
7. Start the engine and keep it running at 1500 to 2500 rpm. Fill the tank to full as necessary, and screw the tank pressure cover back on.
8. Continue running the engine at 1500 to 2500 rpm, until the cooling fan is operating, and then idle the engine until the cooling fan stops operating.
9. Turn the engine off and cool it for 30 minutes.
10. Check the cooling system for any leakage.

Warning: Since injury such as scalding could be caused by escaping steam or coolant, DO NOT open the expansion tank cap while the cooling system is still hot.

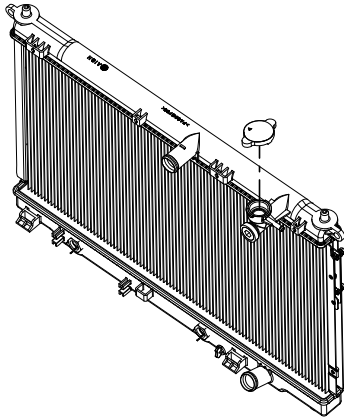
11. Fit the pressure seal cover.
12. Fit the bottom wind deflector panel.

Bottom Wind Deflector Panel Refit

System Pressure Test

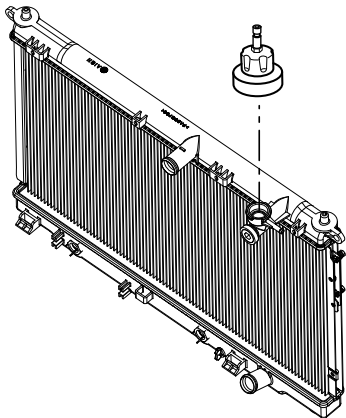
Inspection

1. Check the hoses for any cracks or twists and check the connection of the line.
2. Loosen the radiator pressure seal cover.

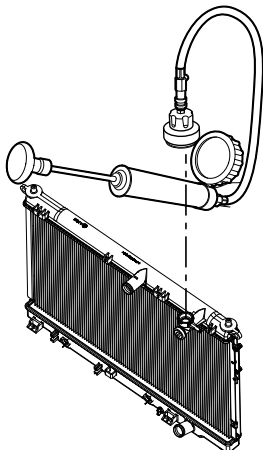


Warning: Since injury such as scalding could be caused by escaping steam or coolant, **DO NOT** open the expansion tank cap while the cooling system is still hot.

3. Fit the **TEN00021** union to the radiator.



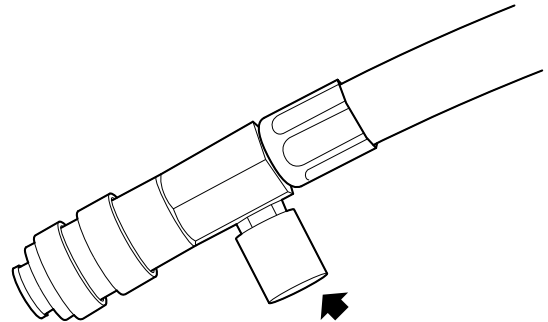
4. Connect the quick joint of the pressure hose to the union.



5. Slowly apply the pressure to the system to 93-123 kPa, and check for leakage.

Warning: **DO NOT** exceed the specified pressure value, or the cooling system will be damaged.

6. Visually check the engine and the cooling system for the traces of coolant leaking.



S143048

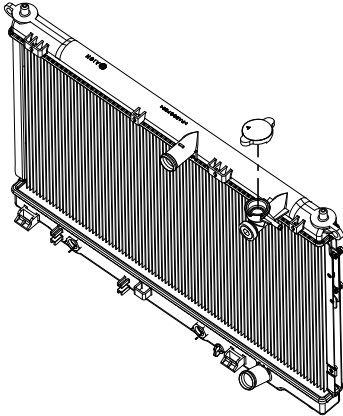
7. Discharge the pressure with the relief valve on **TEN00021**.
8. Remove the hose from the union.
9. Remove the union from the radiator and fit the pressure seal cover.

Pressure Seal Cover - Pressure Test

(High-Pressure Open: 93-123 KPa Low-Pressure Open: 0-9.8 KPa)

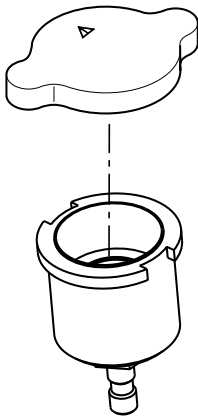
Inspection

1. Visually check the engine and the cooling system for the traces of coolant leaking.
2. Check the hoses for any cracks or twists and check the connection of the line.

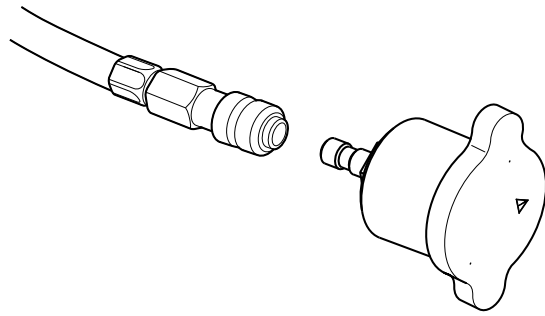


3. Loosen the radiator pressure seal cover.

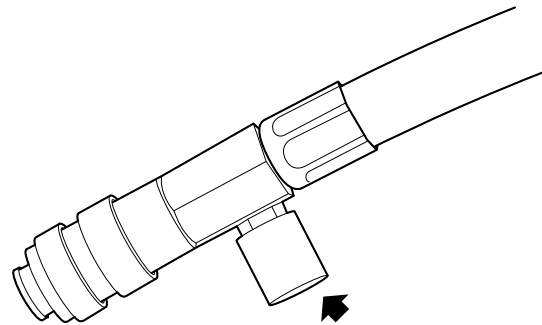
Warning: Since injury such as scalding could be caused by escaping steam or coolant, DO NOT open the expansion tank cap while the cooling system is still hot.



4. Fit the **TEN00020** union to the radiator pressure seal cover.



5. Connect the quick joint of the pressure hose to **TEN00020** union.
6. Slowly apply pressure to the radiator pressure seal cover to the specified value, and check the pressure range can maintain 93-123 kPa, the radiator pressure seal cover is normal.



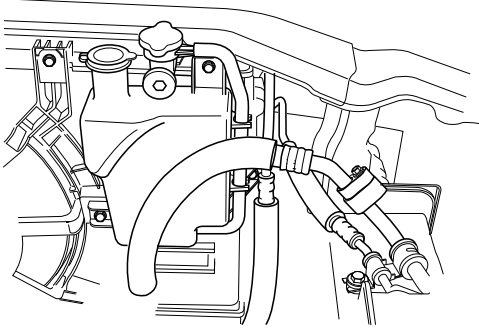
S143048

7. Discharge the pressure with the relief valve on **TEN00020**.
8. Disconnect the quick joint from the pressure hose, and remove the pressure hose from **TEN00020**.
9. Remove the radiator pressure seal cover from the union and fit it to the radiator.

Coolant Expansion Tank

Removal

1. Loosen the fastening clamp between the radiator bleed air hose and the radiator connection end with the clamp plier.
2. Disconnect the bleed air hose and the radiator.
3. Remove the three screws securing the coolant expansion tank.



4. Remove the coolant expansion tank from the vehicle.

Refit

1. Fit the coolant expansion tank on the vehicle.
2. Fit the three screws securing the coolant expansion tank to **5.5–7.5 Nm**.
3. Connect the bleed air hose to the radiator.
4. Secure the radiator bleed air hose with the clamp plier.

Cooling Fan

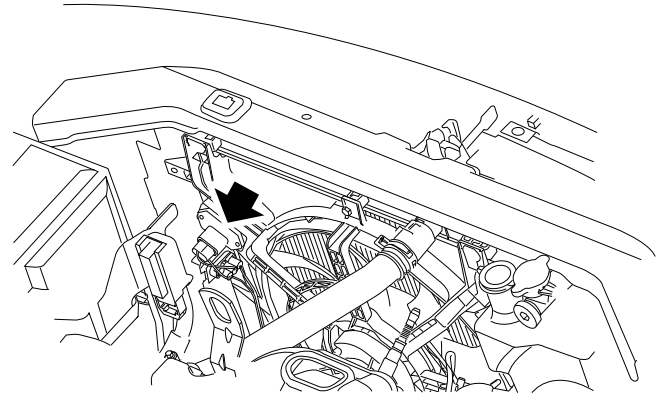
Removal

Warning: Disconnect the battery earth lead before removal to avoid the fan motor runs, resulting in personal injury.

1. Disconnect the battery earth lead.
2. Remove the coolant expansion tank.

Hand Icon Coolant Expansion Tank

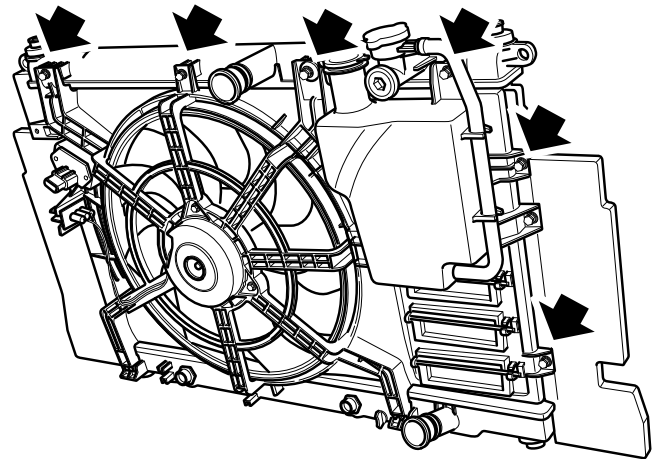
3. Disconnect the cooling fan electrical connector.



4. Remove the cooling fan low speed resistor.

Hand Icon Cooling Fan Low Speed Resistor

5. Remove the cooling fan set screws.

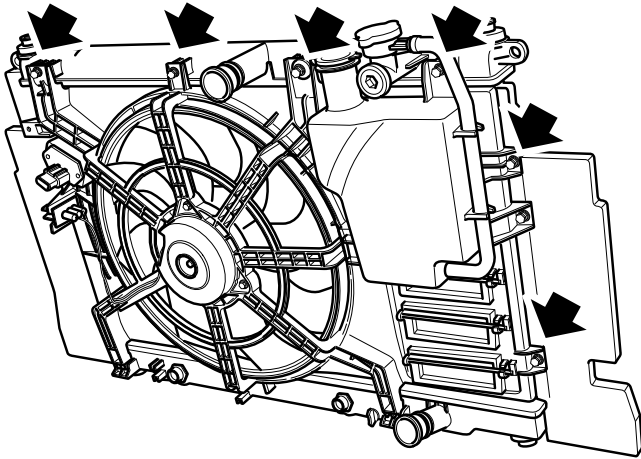


6. Remove the cooling fan from the bottom of the vehicle and fit it.

Refit

Caution: DO NOT remove the fan from the fan motor, the assembly has passed the dynamic balance test and adjustment during manufacturing. It cannot reach this balance requirement when reassembling.

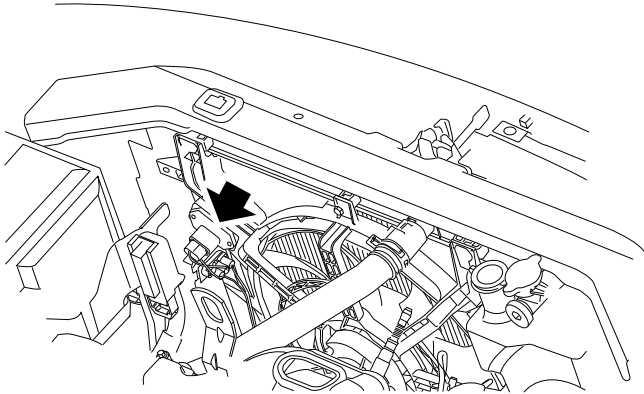
1. Fit the cooling fan on the vehicle.
2. Fit the cooling fan set screws to **5.5–7.5 Nm**.



3. Fit the cooling fan low speed resistor.

 **Cooling Fan Low Speed Resistor**

4. Connect the cooling fan electrical connector.



5. Fit the coolant expansion tank.

 **Coolant Expansion Tank**

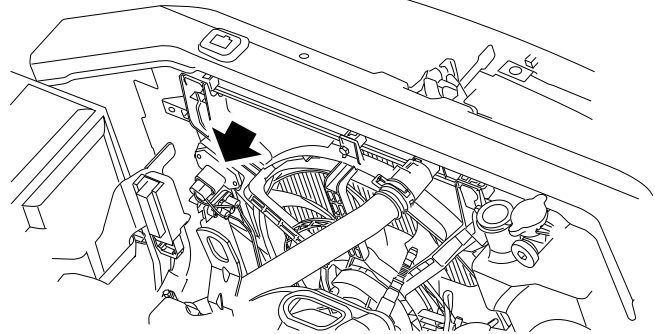
6. Connect the battery earth lead.

Cooling Fan Low Speed Resistor

Removal

Warning: Keep away from the cooling fan. The fan may start automatically without warning, even after the engine is turned off.

1. Disconnect the battery earth lead.
2. Cut off the two wires of the governor resistor, leaving the wire on the governor resistor as short as possible.
3. Remove the cooling fan low speed resistor set screws.
4. Remove the cooling fan low speed resistor.



Refit

1. Fit the cooling fan low speed resistor.
2. Fit the cooling fan low speed resistor set screws to **5.5–7.5 Nm**.
3. Connect the two wires between the governor resistor and the fan.
4. Connect the battery earth lead.

Radiator

Removal

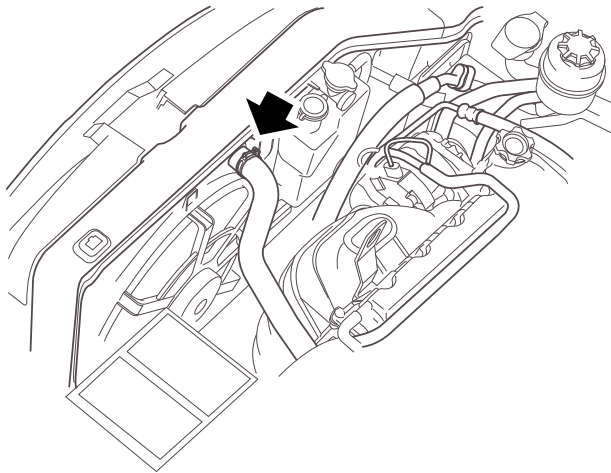
1. Disconnect the battery earth lead.
2. Drain the coolant.

Drain and Refill the Coolant

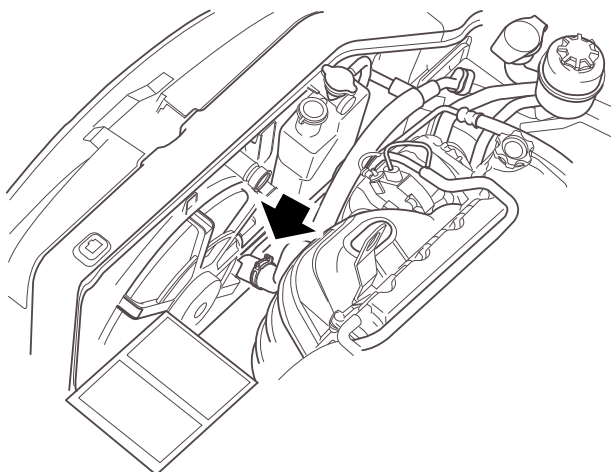
3. Remove the air cleaner inlet pipe.

Air Cleaner Inlet Pipe

4. Put an appropriate container under the automatic transmission fluid outlet on the radiator to collect the flowing automatic transmission fluid. (Only for the automatic transmission model)
5. Loosen the radiator hose inlet clamp with the clamp plier, and disconnect the radiator hose inlet from the radiator.



6. Remove the radiator hose outlet clamp with the clamp plier, and disconnect the radiator hose outlet from the radiator.



7. Disconnect the quick joints of the 2 automatic transmission fluid cooling hoses from the radiator pipe sleeve. (Only for the automatic transmission model)

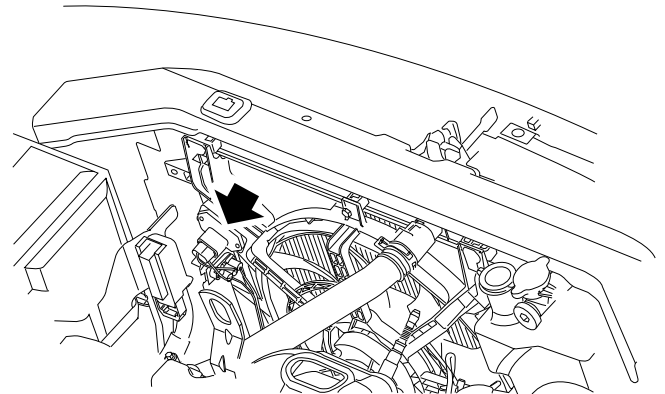
Warning: Take extra care, as the drained transmission fluid temperature is very high.

Caution: Plug the disconnected unions to prevent contamination entering.

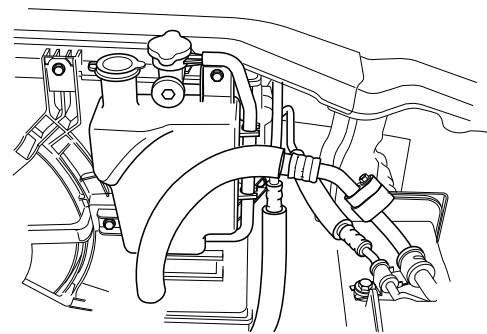
8. Remove the radiator upper crossmember.

Radiator Upper Crossmember

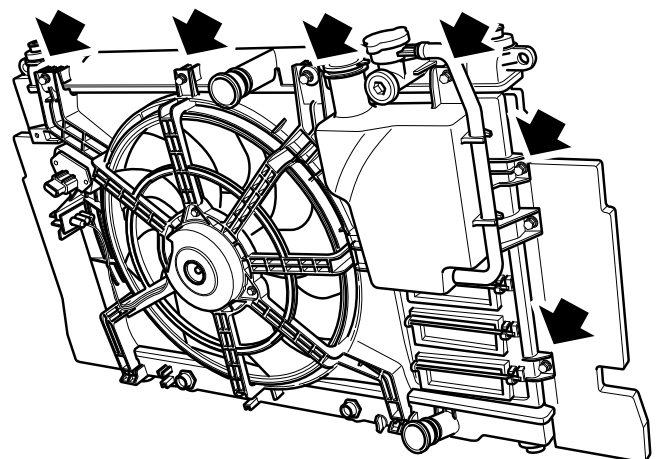
9. Disconnect the cooling fan electrical connector from the main wire.



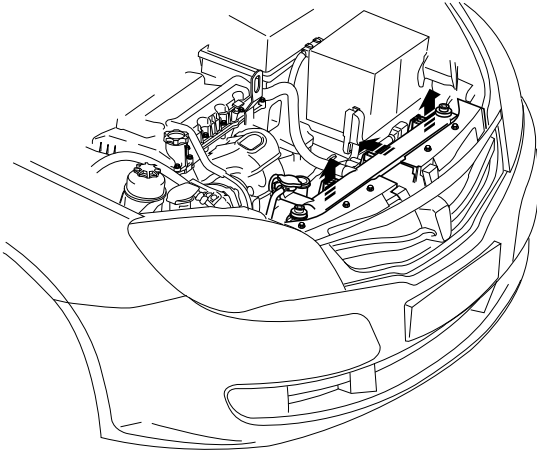
10. Loosen the overflow hose clamp with the clamp plier, and disconnect the overflow hose.




11. Remove the radiator cooling fan assembly fastening screws.

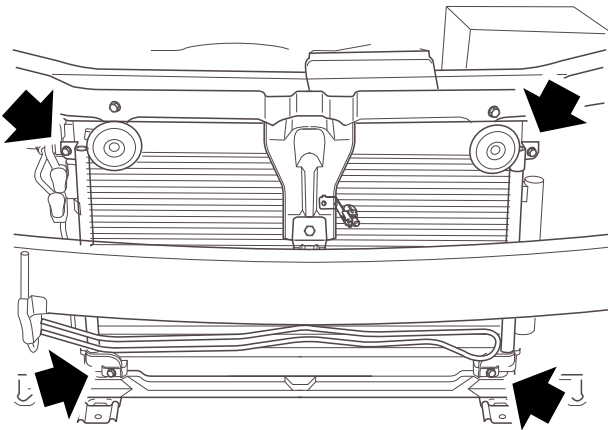


12. Remove the cooling fan together with the expansion tank from the top.
13. Lift the radiator up from the base, and move it towards the engine.



- with the clamp.
- 12. Add automatic transmission fluid. (Only for the automatic transmission model)
- 13. Refill coolant.
-  **Refill Coolant**
- 14. Connect the battery earth lead.

14. Remove the condenser fastening screws.



15. Remove the radiator from the top.

Refit

1. Place the radiator into the engine bay.
2. Secure the condenser to the radiator with bolts, and tighten the bolts to **5.5–7.5 Nm**.
3. Fit the radiator to the radiator lower crossmember base.
4. Fit the cooling fan and the expansion tank on the radiator.
5. Connect the quick joints on the radiator pipe sleeve that connect the 2 automatic transmission fluid cooling hoses. (Only for the automatic transmission model)
6. Fit the cooling fan fastening bolts, and tighten them to **5.5–7.5 Nm**.
7. Fit the radiator upper crossmember.

 **Replacement of Radiator Upper Crossmember**

8. Connect the cooling fan electrical connector to the main wire.
9. Fit the radiator overflow hose to the radiator, and tighten it with the clamp.
10. Fit the radiator hose outlet to the radiator, and tighten it with the clamp.
11. Fit the radiator hose inlet to the radiator, and tighten it

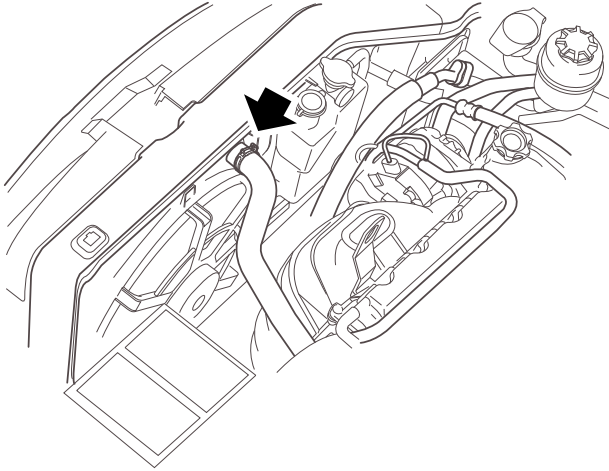
Radiator Hose Inlet

Removal

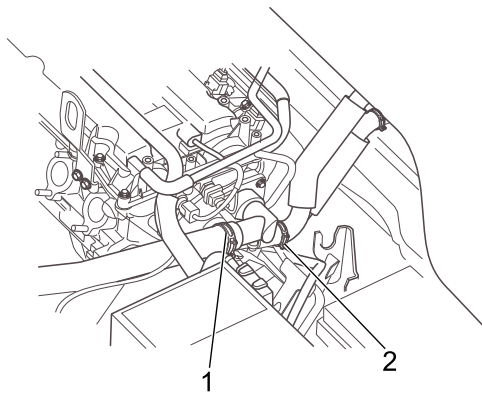
1. Drain the coolant.

 **Drain Coolant**

2. Loosen the radiator hose inlet clamp with the clamp plier, and disconnect the radiator hose inlet from the radiator.



3. Loosen the radiator hose inlet clamp (1) with the clamp plier, and disconnect the radiator hose inlet from the engine.



4. Remove the radiator hose inlet from the vehicle.

Refit

1. Fit the radiator hose inlet to the vehicle.
2. Fit the radiator hose outlet to the radiator, and tighten it with the clamp.
3. Fit the radiator hose outlet to the engine, and tighten it with the clamp.
4. Refill coolant.

 **Refill Coolant**

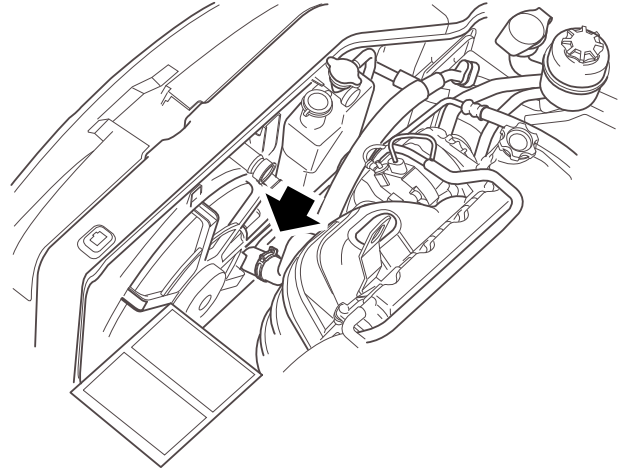
Radiator Hose Outlet

Removal

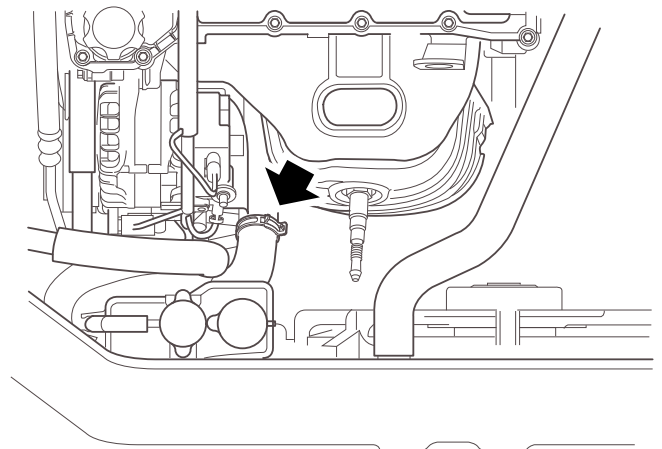
1. Drain the coolant.

 **Drain Coolant**

2. Loosen the radiator hose outlet clamp with the clamp plier, and disconnect the radiator hose outlet from the radiator.



3. Loosen the radiator hose outlet clamp with the clamp plier, and disconnect the radiator hose outlet from the water pump pipe.



4. Remove the radiator hose inlet from the vehicle.

Refit

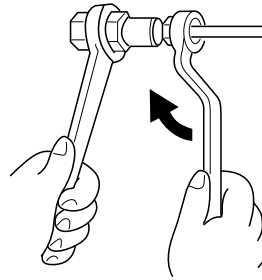
1. Fit the radiator hose inlet to the vehicle.
2. Fit the radiator hose outlet to the radiator, and tighten it with the clamp.
3. Fit the radiator hose outlet to the engine, and tighten it with the clamp.
4. Refill coolant.

 **Refill Coolant**

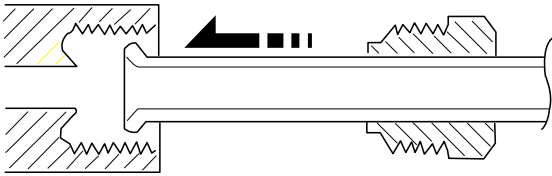
Tube Joint

Refit

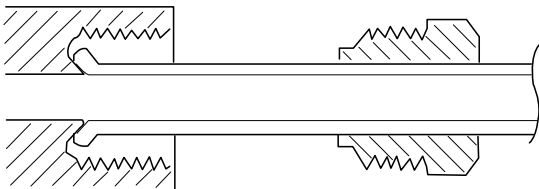
Caution: When assembling the cooling pipe, be sure to fit it in the given order, and never turn the cooling pipe after the assembly was finished, otherwise, it may cause the bolt to break, case to crash or the pipe to leak.



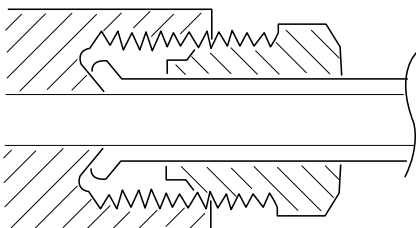
1. Insert the oil pipe into the joint.



2. Align the oil pipe joint with the transmission case mounting hole.



3. Temporarily tighten the set nut.



4. Tighten the set nut to the predetermined value.

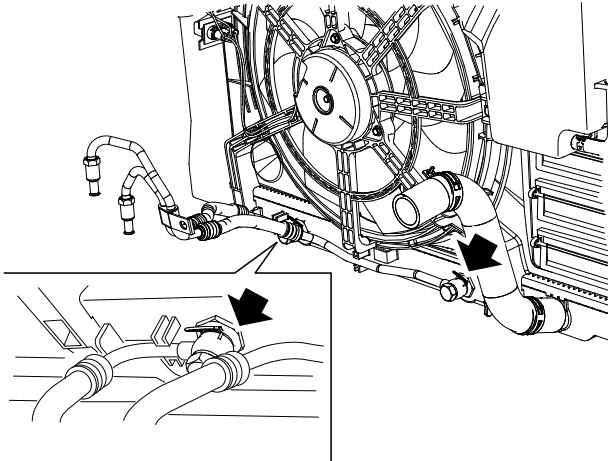
Automatic Transmission Case Oil Cooling Pipe

Removal

1. Drain partial transmission oil.

 **Drain Transmission Oil**

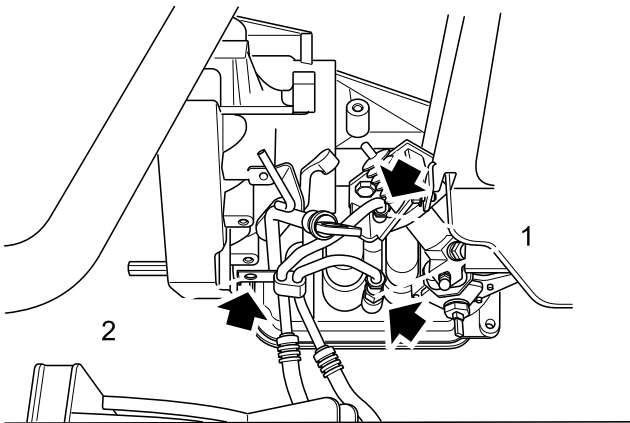
2. Remove the oil cooling pipe fastening bolts on the oil cooler, and dispose of the gasket seal.



Warning: Take extra care, as the drained transmission fluid temperature is very high.

Caution: Plug the disconnected unions to prevent contamination entering.

3. Remove the transmission case oil cooling pipe assembly bracket set bolt (2).
4. Remove the oil cooling pipe fastening bolts (1) on the transmission, and dispose of the gasket seal.



Caution: Plug the disconnected unions to prevent contamination entering.

5. Remove the transmission case from the vehicle.

Refit

1. Fit the transmission case oil cooling pipe assembly to the vehicle.
2. Fit the new gasket seal to the transmission case oil cooling pipe assembly.
3. Fit the transmission case oil cooling pipe assembly to the transmission.

4. Fit the oil cooling pipe fastening bolts, and tighten to **35-40 Nm**.
5. Fit the transmission case oil cooling pipe assembly bracket set bolts, and tighten to **7-10 Nm**.
6. Fit the transmission case oil cooling pipe assembly to the oil cooler.
7. Fit the oil cooling pipe fastening bolts, and tighten to **35-40 Nm**.
8. Refill the transmission with the transmission oil to the specified value.

 **Add Transmission Oil**

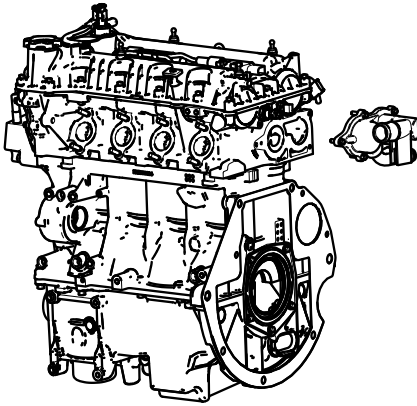
Thermostat

Removal

1. Drain the engine coolant.

Warning: Exhaust components may be extremely hot, in order to avoid the danger of being burnt, etc., handling must be performed after the system has sufficiently cooled down.

2. Loosen the clamp, and remove the heater hose inlet.
3. Loosen the clamp, and remove the tank hose inlet.
4. Unscrew the 5 bolts assembling the thermostat housing assembly one by one.
5. Remove the damaged thermostat and dispose of it.

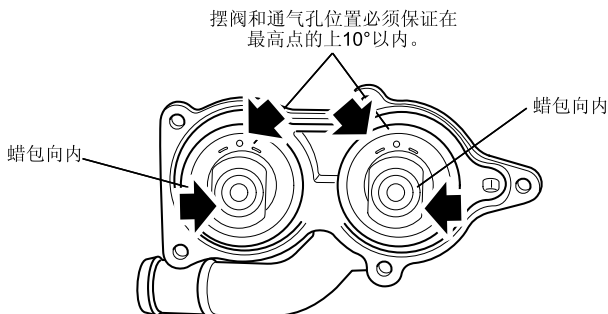


4. Tighten the bolts in order, and the tightened torque is **8–12 Nm**.
5. Fit the tank water pipe inlet and secure it with clamp.
6. Fit the heater water pipe inlet and secure it with clamp.

6. Remove the seal washer, and dispose of it.

Refit

1. Fit the new seal washer.
2. Fit the thermostat into the thermostat housing, the main thermostat sealing wax with the swing valve facing outwards and the sub-thermostat sealing wax without the swing valve facing inwards, and rotate both of the thermostats respectively to locate the swing valve and the breather hole at the highest point $\pm 10^\circ$ as shown in the illustration.



3. Place the thermostat housing assembly on the appropriate location of the cylinder head, fit the bolts, and pretighten them.

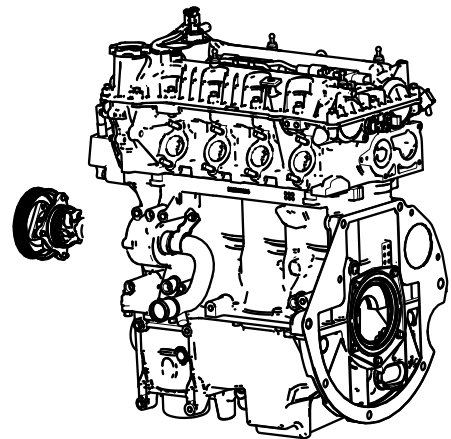
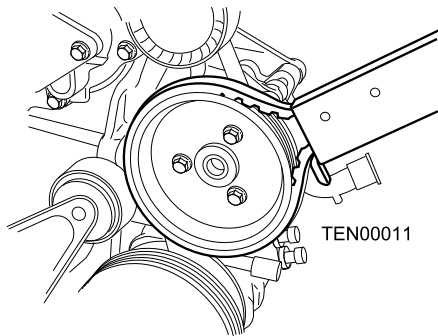
Water Pump

Removal

1. Pre-loosen the 3 bolts connecting the water pump pulley to the pulley hub, just loosen them, and DO NOT remove.
2. Remove the accessory drive belt.

 **Accessory Drive Belt**

3. Remove the 3 bolts connecting the water pump pulley to the pulley hub, and remove the pump pulley.

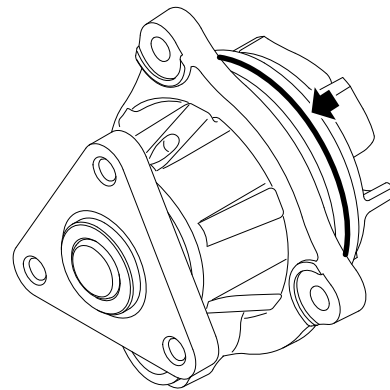
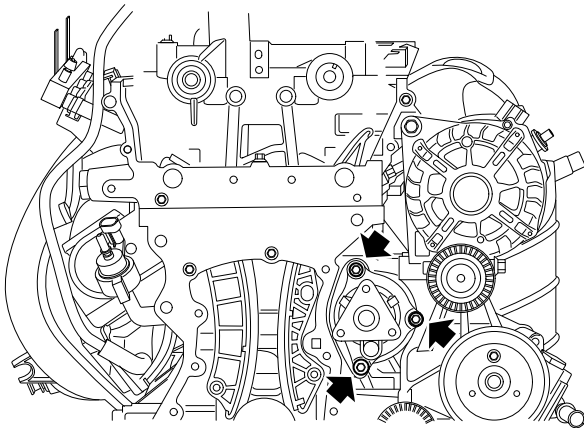


Refit

1. Since the water pump assembly is a unit, it cannot be disassembled any more. After the water pump assembly is removed, inspect the cause of the water pump failure according to the failure condition. If just the damage of the seal ring causes the leakage, then change a new seal ring. If there is a damage in other parts, it is necessary to change the water pump assembly.

S111J423

4. Remove the 3 bolts connecting the water pump housing to the cylinder block.



Caution: When removing the water pump, be careful not to pry in radial direction, if it is difficult to pull out, hold the water pump cover and turn in axial direction until the water pump is taken out from the cylinder block.

5. Remove the water pump from the engine.

2. Fit the water pump (DO NOT lubricate with oil lubricant, and apply refrigerant to lubricate is recommended); rotate the pump in the axial direction and firmly press it until it snags with the pump mounting surface of the cylinder block. Notice that location pin is not designed in the water pump to allow it to rotate in the circumferential direction, so take care to align the water pump mounting hole with the appropriate bolt hole in the cylinder block when fitting.
3. Fit the 3 service bolts connecting the water pump and the cylinder block, and the torque is **8–12 Nm**.
4. Fit the water pump pulley.
5. Fit the 3 service bolts connecting the water pump pulley and the pulley hub, and just pretighten them.
6. Fit the accessory drive belt.

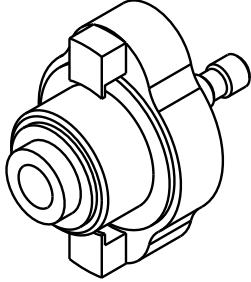
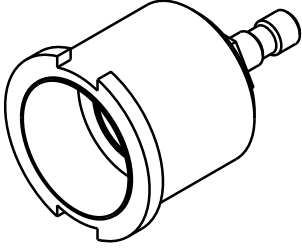
 **Refit**

7. Tighten the 3 service bolts connecting the water pump

pulley and the pulley hub, and the torque is **9–11 Nm**.

Warning: *Exhaust components may be extremely hot, in order to avoid the danger of being burnt, etc., handling must be performed after the system has sufficiently cooled down.*

Special Tools

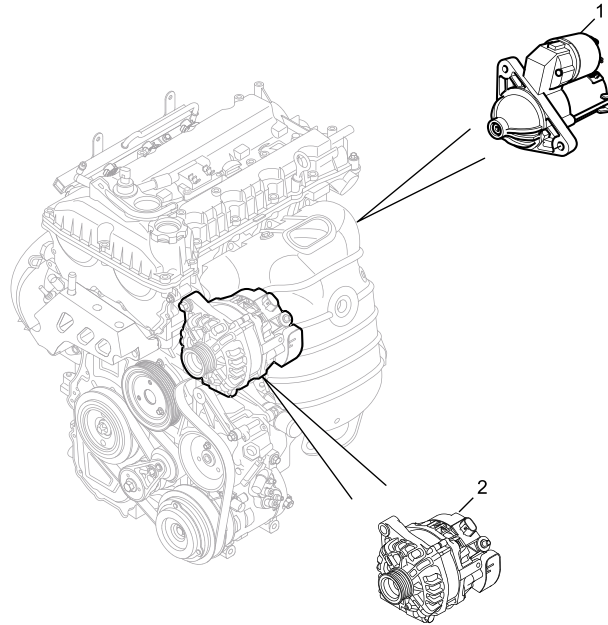
| Tool Number | Description | Picture |
|-------------|--|---|
| TEN00021 | Cooling System Test Pressure Connector |  <p>TEN00021</p> |
| TEN00020 | Tank Cover Opening Pressure Test Tool |  <p>TEN00020</p> |

Engine Electrical System**Specifications****Torque**

| Description | Value |
|---|---------|
| Bolt - Starter Motor Wire Harness Bracket | 7–10 Nm |
| Bolt - Starter Motor | 25 Nm |

Description and Operation
System Component Layout

Starting and Charging System Component Layout



1. Starter

2. Generator

Description**General Description**

The starting system of the vehicle includes a 12 V starter motor which can drive the engine to begin the combustion process, so that the electric energy is converted into mechanical energy. The power system of the vehicle must be able to provide enough energy to ensure that the starter motor can rotate the crankshaft.

The charging system consists of the battery, generator and related electrical elements.

The battery provides energy for the engine cranking and initial ignition. When the electrical demand exceeds the engine output, the battery can provide energy in a certain amount of time. It can stabilize the voltage when the engine voltage fluctuates.

When the engine is running, the alternator receives mechanical energy from the crankshaft and converts it into electric energy which is provided for the operation of the electrical elements in the vehicle and charging the battery. The charge indicator is fitted in the instrument pack. It will be turned on when the alternator does not output voltage or the voltage is below the battery voltage.

Alternator

The alternator is fitted on the right front of the engine and secured on two aluminum brackets with two screws and flange face nuts. Several fitting methods are provided for the alternator in order to match different additional devices. The drive pulley secured on one end of the rotor drives through the V-ribbed belts, to obtain power from the crankshaft. The location of the alternator is fixed and the belt tension is maintained by the far-end automatic tensioner pulley.

The alternator is similar in the structure, all including a stator, a rotor, a rectifier and a adjuster. The one-way output end is connected to the battery positive with a cable. The alternator is grounded through its bracket. The three-pin connector supplies power for the charging warning light and ignition system battery, and connection for the engine control module alternator charging signal.

The rotor is made of an iron core with a field coil wound on it and assembled on a shaft. The iron core extends to its two ends, forming the south and north poles of the magnetic line of force in the coil. The rotor is located in the stator, and the bearing is assembled to ensure smooth operation and to provide support for the rotor while one end of the rotor is undergoing the load from the drive belt.

The stator includes a stator iron core and a stator coil with both ends supported by brackets. The stator is made of thin soft iron plate with a groove suitable for the stator coil and it is secured to the alternator housing. The stator has three

coil windings, and the copper wires are coated with enamel paint for insulation. The three coil windings are connected to a "planetary connector", so the end of each winding is connected to another two windings. The output current is provided through the other end of each winding. The magnetic flux generated by the rotor magnetic pole is allowed to pass the stator coil. The alternating current is generated in the coil by the rotation of the rotor.

The rectifier is located on the rear of the alternator, which converts the alternating current generated into the stator coil to the direct current needed by the electrical system of the vehicle. The rectifier includes 6 semiconductor diodes which are fitted on the fins with high heat dissipation. Three diodes are on the front side, three on the back side and the other two in the middle. The rectifier also prevents the current flowing from the battery to the alternator when the output voltage of the alternator is below the battery voltage.

The integrated circuit adjuster is also located in the rear of the alternator. It controls the output voltage of the alternator to prevent the battery from being overcharged and prevents the input voltage of the vehicle electrical system from being too high by controlling the magnetic field current of the rotor. The adjuster voltage set value changes with the temperature to optimize the battery charging. The rated output voltage is set at 14.5 V and is changed according to the load of the battery and the load required by the vehicle electrical system.

The transistor in the adjuster can change the switch rapidly through the internal induction voltage to adjust the output voltage. The adjuster which has a charging warning light output end can control the operation of the warning light. If the output voltage of the alternator is below the battery voltage, the warning light will illuminate. The electrical load compensation signal is also provided by the adjuster, and the output data is provided for the engine control module which can suit for various electrical loads by adjusting the idle speed.

The initial excitation current of the alternator is provided to the rotor through the brush contacting the slip ring at the end of the rotor shaft when the alternator is operating at low speed. When the alternator speed increases, the alternator becomes self-excitation.

Starter Motor

The starter motor is located in the left rear of the engine and secured in the threaded hole of the transmission housing with two flange face screws.

Each starter motor is electromagnetic mesh type and includes a series of a wire motor, a 1 way clutch and an entire coil. When the ignition switch is turned to the START position, the body control module sends a signal to provide voltage to the starter relay coil. When the engine is about to start, check if

the correct feature coding is received before the start request is allowed by the body control module.

Battery

The battery in the electrical system has three main features. Firstly, the battery provides power for starting the engine. Secondly, the battery is used as the voltage adjuster of the electrical system. Lastly, the battery can provide energy in a certain amount of time when the electrical demand exceeds the engine output.

All vehicles are equipped with standard packaged maintenance-free lead-acid battery. All the batteries are the same in the construction, and only different in the battery capacity depending on the different needs of the engine and transmission accessory. The battery is sealed completely, but there is a vent hole on either side of the battery top cover. The vent holes can allow small amount of gas generated in the battery to blow out.

Compared with the conventional battery, the packaging battery has following advantages:

- There is no need to add water during the entire life cycle of the battery.
- It adopts the overcharge protective measures. If the voltage applied to the battery is too high, it will not receive the excess current as the conventional battery will. For the conventional battery, if the battery continues to be charged when the voltage is too high, air leakage will occur, causing fluid loss.
- Compared with the conventional battery, self discharge does not tend to occur for this kind of battery. This is especially important when the battery is not used for a long time.
- For the cigar lighter and smaller electrical equipment, the electric quantity supplied is more reliable.

A built-in, temperature compensated hydrometer is located on the top of the battery to provide the related density of the

electrolyte and visual indication of the fluid level. The different colors of the indicator indicate the different conditions of the battery as follows:

- Green - indicates that the battery does not need to be charged and it is in the available condition.
- Fade out (to black) - indicates that the battery is low in power and needs to be charged.
- Transparent or yellow - indicates that the battery can no longer be used and must be replaced.

If the indicator is transparent or yellow, the battery has internal malfunction. When the battery is in such a state, it is prohibited to charge the battery or start the vehicle.

The battery fluid (electrolyte) contains the sulfuric acid. If it comes in contact with your skin or eyes, burns may be caused. Wear protective clothing and face shield. If the electrolyte drops on your skin or clothes, wash it with water immediately. If the electrolyte gets in your eyes, wash with clean water for at least 15 minutes and seek for medical care.

When removing the battery, make sure the alarm is disabled and the ignition is turned off. Always disconnect the negative terminal before disconnecting the positive terminal. When the battery is refitted, always connect the positive terminal before connecting the negative terminal.

After the battery is removed due to service, make sure that the battery fitting belt does not cover the vent hole on the top of the battery when refitting.

If the battery is discharged completely, it must be removed from the vehicle and recharged. The battery must be recharged with a charger under constant current. DO NOT use the quick charger, or the battery will be damaged permanently.

Operation

Alternator

The alternator uses the self-excitation system in which the rectifier diode supplies part of the current generated by the alternator for the rotor. The alternator is not able to supply the initial current to start the charging procedure. The initial current is supplied by the ignition switch on the battery input end, and it activates the magnetic field winding to start the charging procedure. When the ignition switch is turned on, the battery voltage is also supplied through the charging warning light and grounded through the magnetic field winding of the alternator, thus illuminating the warning light of the light emitting diode.

When the engine starts, which rotates the rotor in the stator, the 3-phase alternating current is generated. When the rotor speed increases, the output voltage increases rapidly, increasing the potential difference on the output end of the magnetic field diode. The charging warning light fades out when the voltage increases and turns off when the output voltage of the alternator equals the battery voltage. At this

time, the alternator can achieve enough self-excitation current from the rectifier diode and begin charging the battery. If the charging warning light still illuminates, the charging system is malfunctioning and must be checked, or the battery will be damaged.

Starter Motor

When the ignition switch is turned to the START position, the coil provides power to engage the pinion and flywheel ring gear. The pinion moves spirally on the motor shaft, so the motor shaft provides smooth combination through the ring gear. On the starter motor, the motor drives the pinion through the transmission, not directly through the motor shaft.

While the engine is being cranked, the 1 way clutch prevents the overspeed running of the motor armature. The driver should not take the key from the START position to maintain the continuous operation of the starter motor.

After the engine starts, energy is released from the solenoid coil and the pinion is pulled out of the ring gear when the ignition switch is turned off.

Service Procedures

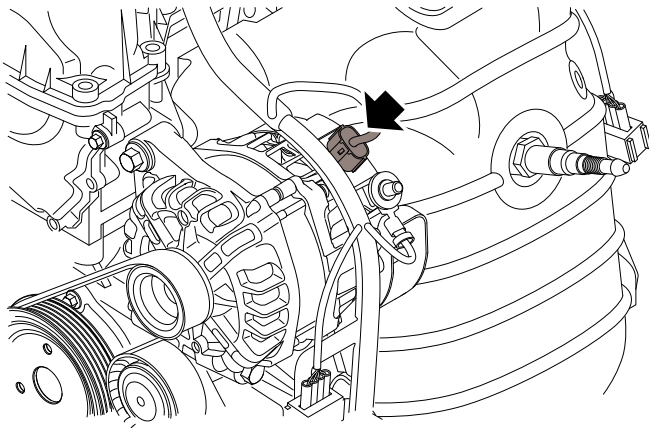
Generator

Removal

1. Lift up the front of the vehicle.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

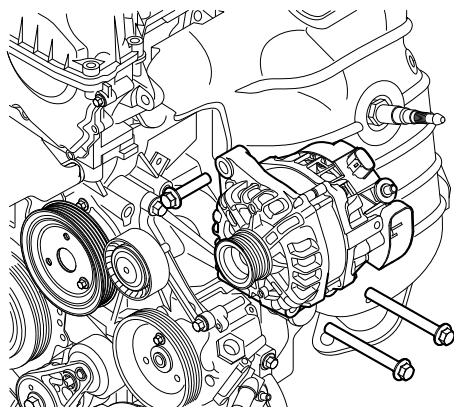
2. Disconnect the battery earth lead.
3. Remove the connector of the generator and engine wire.



4. Remove the sub drive belt.

Sub Drive Belt

5. Remove the 3 bolts connecting the generator, cylinder head and cylinder block.



S841A402Z

6. Remove the generator.

Refit

1. Clean the generator and mating surface between the cylinder head and cylinder block.
2. Fit the 3 bolts connecting the generator, cylinder head and cylinder block.
3. Fit the sub drive belt.

Sub Drive Belt

4. Fit the connector of the generator and engine wire.

5. Connect the battery earth lead.
6. Lower the vehicle.

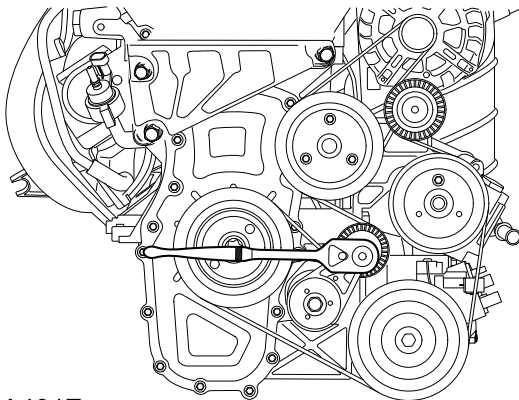
Sub Drive Belt

Removal

1. Raise the vehicle to a height that is suitable for operation.

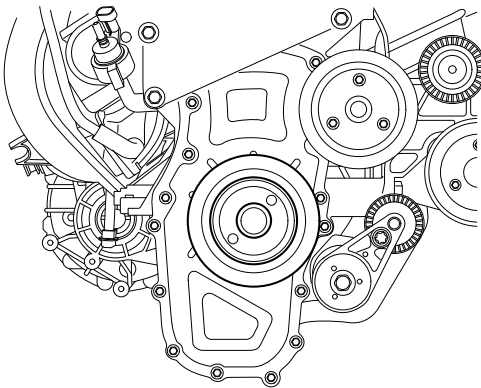
Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

2. Disconnect the battery earth lead.
3. Insert the replacer into the square hole in the tensioner, and turn the torque wrench counterclockwise with the torque of no more than 82 Nm to disengage the tensioner and belt.



S112A401Z

4. Remove the belt.

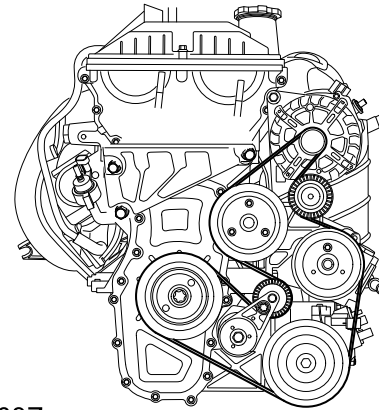


S112A402Z

5. Return the tensioner slowly and remove the tool.

Refit

1. Insert the replacer into the square hole in the tensioner, and turn the torque wrench counterclockwise with the torque of no more than 82 Nm.
2. Fit the sub drive belt to each pulley groove, tensioner pulley and idler gear in the direction as shown in the illustration.




S112A403Z

3. Loosen the tensioner slowly. Be careful to make sure that the belt is basically in the middle of the tensioner pulley and there is a margin of at least 2 mm on either side of the tensioner pulley after refit of the belt.
4. Remove the tool.
5. Connect the battery earth lead.
6. Lower the vehicle.

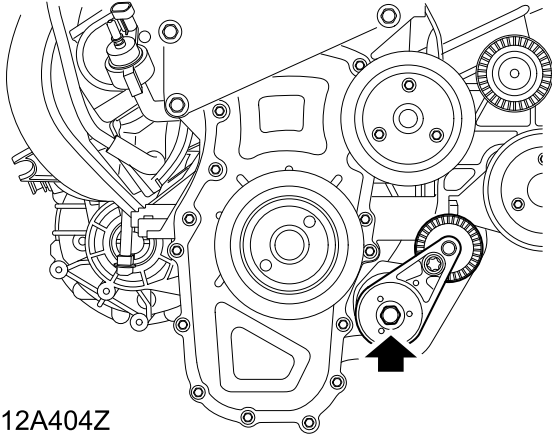
Sub Drive Belt Tensioner

Removal

1. Remove the sub drive belt.

 **Sub Drive Belt**

2. Remove the sub drive belt tensioner bolts.



S112A404Z

3. Remove the sub drive belt tensioner.

Refit

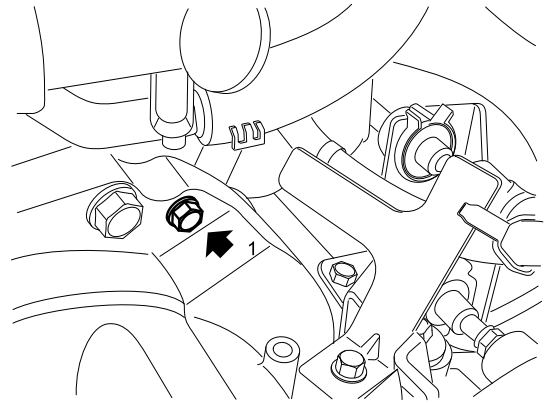
1. Tighten the sub drive belt tensioner bolts.
2. Fit the sub drive belt.

 **Sub Drive Belt Refit**

Starter Motor

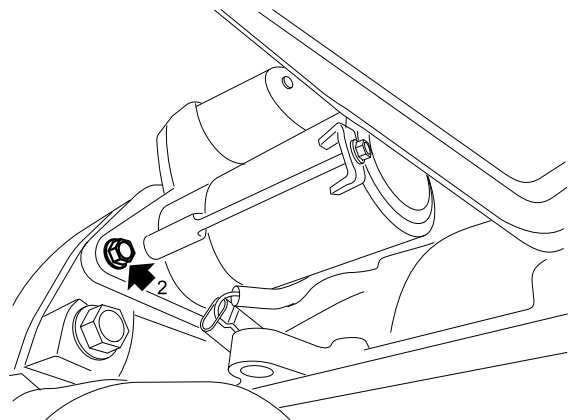
Removal

1. Disconnect the battery negative terminal.
2. Unscrew the nuts and disconnect the battery wire from the starter motor solenoid coil.
3. Remove the starter motor set bolt 1.



S112B401

4. Remove the starter motor set bolt 2 from the bottom of the vehicle.



S112B402

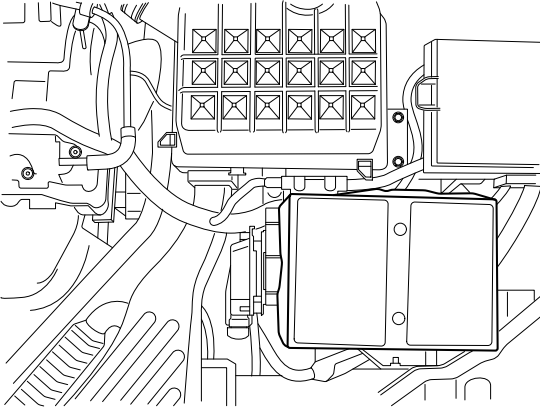
5. Remove the bond cable from the starter.

Refit

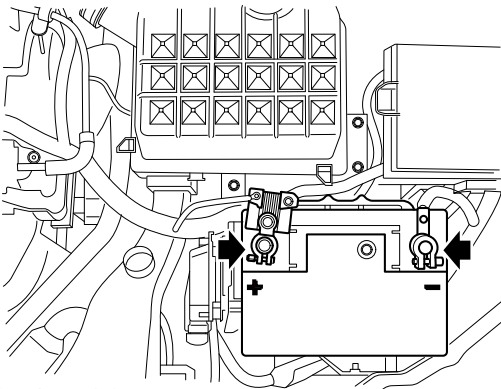
1. Clean the mating surface of starter motor and transmission, and clean the pin and pin hole.
2. Secure the battery wire to the starter motor solenoid coil, and tighten the nuts to **7–10 Nm**. Connect the engine wire with the starter connector.
3. Fit the starter motor, fit the bolts and tighten them to **25 Nm**.
4. Connect the battery ground.

Battery**Removal**

1. Disconnect both battery electrodes, and disconnect the earth lead first.

**S841B401**

2. Remove the battery heat insulator.

**S841B402**

3. Unscrew the bolts securing the battery attaching clamp, and remove the clamp.
4. Remove the battery.

Refit

1. Place the battery in the proper position on the battery tray.
2. Place the battery clamp in the proper position on the battery tray, and align it with the hole.
3. Fit 2 bolts with flange, and tighten them to the specified torque.

Engine Fuel & Management System

Specifications

Torque

| Description | Value |
|--|------------|
| - Spark Plug | 20-30 Nm |
| Bolt - Ignition Coil | 8-12 Nm |
| Bolt - ECM | 8-10 Nm |
| - Water Temperature Sensor | 14-18 Nm |
| - Oil Temperature Sensor | 14-18 Nm |
| Bolt - Crankshaft Position Sensor | 8-12 Nm |
| Bolt - Camshaft Position Sensor | 8-12 Nm |
| Bolt - Camshaft Phase Modulator | 70-80 Nm |
| - Oil Pressure Switch | 14-18 Nm |
| Bolt - Knock Sensor | 15-25 Nm |
| - Fuel Rail to Intake Manifold | 8-12 Nm |
| - Oxygen Sensor | 50-60 Nm |
| Bolt - Absolute Temperature Sensor - Intake Manifold | 4-5 Nm |
| Bolt - Canister to Body | 16-18 Nm |
| Nut - Fuel Filter Bracket | 6-7 Nm |
| - Fuel Pump Locking Ring | 80-85 Nm |
| Bolt - Fuel Tank Steel Strip | 21-25 Nm |
| Bolt - Filler Pipe Support | 6-7 Nm |
| - Filler Pipe to Fuel Tank Hose | 3-5 Nm |
| - Fuel Inertia Switch | 1.6-2.4 Nm |

Parameter

1.5 VCT - Engine Management System

| | |
|--------------------------------|---|
| Manufacturer/Model | Bosch UAES/ME 7.9.7.1 |
| Emission Standard | EU4 |
| Spark Plug: | |
| NGK | PFR6Y |
| Gap | 0.8–0.9 mm |
| Ignition Coil: | |
| Manufacturer | BERU |
| Model | 2 × double-spark ignition coils, top plug-in type, cylinder 1 and 4 share one, cylinder 2 and 3 share the other |
| Primary Resistance (Typical) | 0.67 ± 0.07 Ω @ 20°C |
| Secondary Resistance (Typical) | 10.2 ± 2 kΩ @ 20°C |
| Fuel Injection System: | |
| Model | Fuel returnless system and multiport fuel injection system which are electronically controlled by ECM |
| ECM | |
| Nozzle: | Bosch non-contact type, electronic engine management system |
| Operation Pressure | 4 × EV6 |
| Fuel Static Flow of Nozzle | 3.80 Bar |
| | 154.2 g/min |

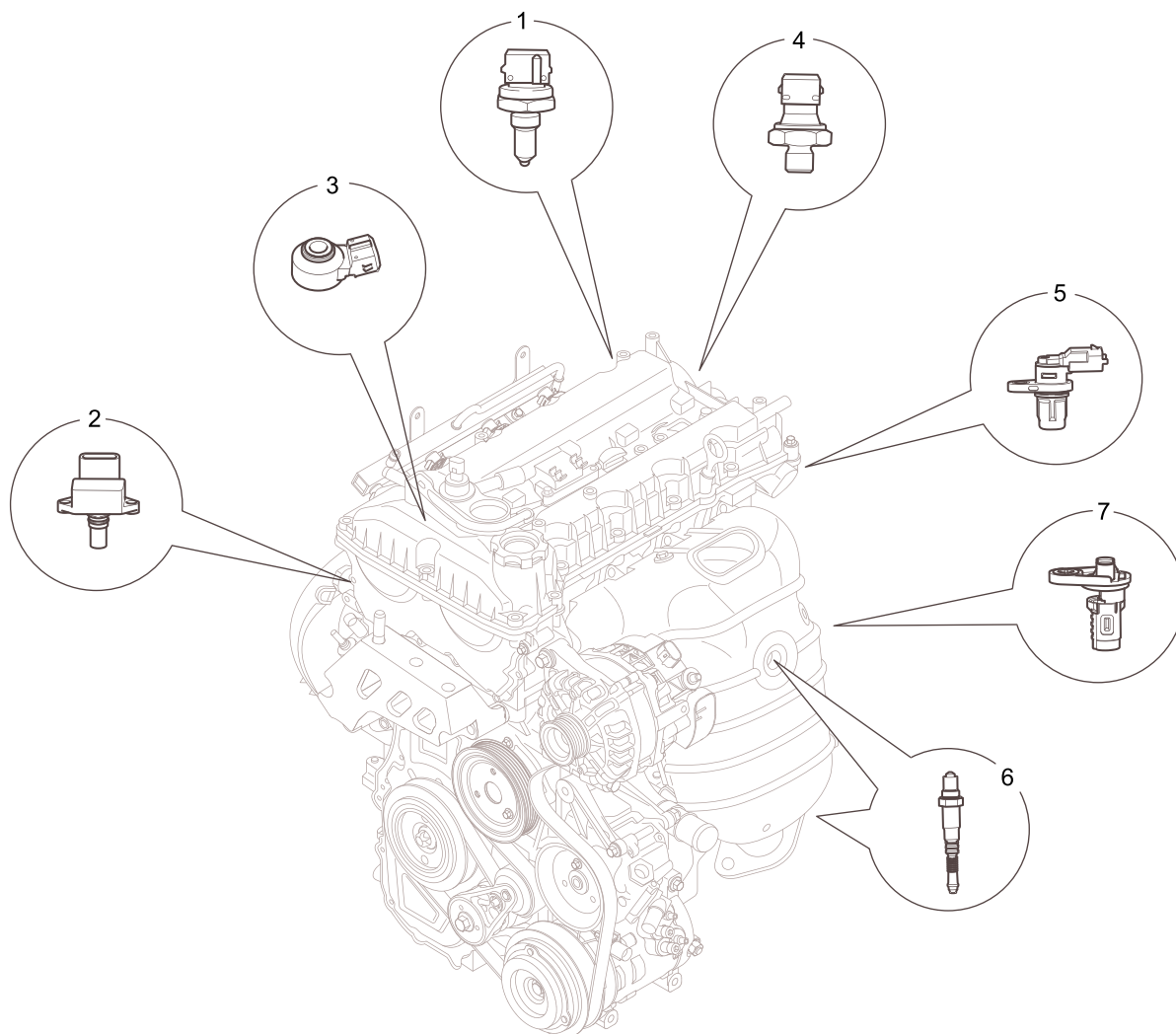
Sensor – 1.5 VCT

| | |
|---------------------------------|---|
| Sensor: | |
| Crankshaft Sensor | UAES BOSCH, hall type sensor that receives signals from side of the signal plate |
| Camshaft Sensor: | |
| Manufacturer/Model | UAES BOSCH, hall type sensor that receives signals from side of the camshaft signal plate |
| Oxygen Sensor: | |
| Manufacturer/Model | UAES BOSCH LSF4.2 |
| Heating Element (Nominal Value) | 7 W |
| Sensor Voltage - High | ≈ 800 mv |
| Sensor Voltage - Low | ≈ 50 mv |
| Electronic Throttle Valve | |
| Manufacturer | UAES BOSCH |
| Total Resistance of Rail | 1.25 KΩ ± 30% |
| Coolant Temperature Sensor: | TEMB/NTC |
| Manufacturer/Model | |
| TMAP Sensor: | UAES BOSCH |
| Manufacturer | 5 V ± 4% |
| Sensor Supply Voltage | |

Fuel System – 1.5 VCT

| | |
|-----------------------------|---|
| System | Fuel returnless system and multiport fuel injection which are electronically controlled by ECM |
| Fuel Specification | Unleaded 93 RON |
| Fuel Rail | Stainless steel tube structure |
| Nozzle: | 4 × EV6 |
| Fuel Static Flow of Nozzle | 154.2 g/min @ 3.8 Bar |
| Fuel Dynamic Flow of Nozzle | 4.8 mg/pulse @ 2.5 ms × 10 ms |
| Fuel Pump | Electronically controlled vane pump which injects continuously and immerses in the fuel tank |
| Oil Pressure | 3.8 Bar/13.5 V |
| Oil Pressure Adjustment | Controlled by the pressure adjuster in the fuel tank |
| Fuel Pump Delivery | 0.65 L/min. @ 3 Bar |
| Fuel Filter | External, non-replaceable filter element |

Description and Operation
System Component Layout
Sensor Component Layout

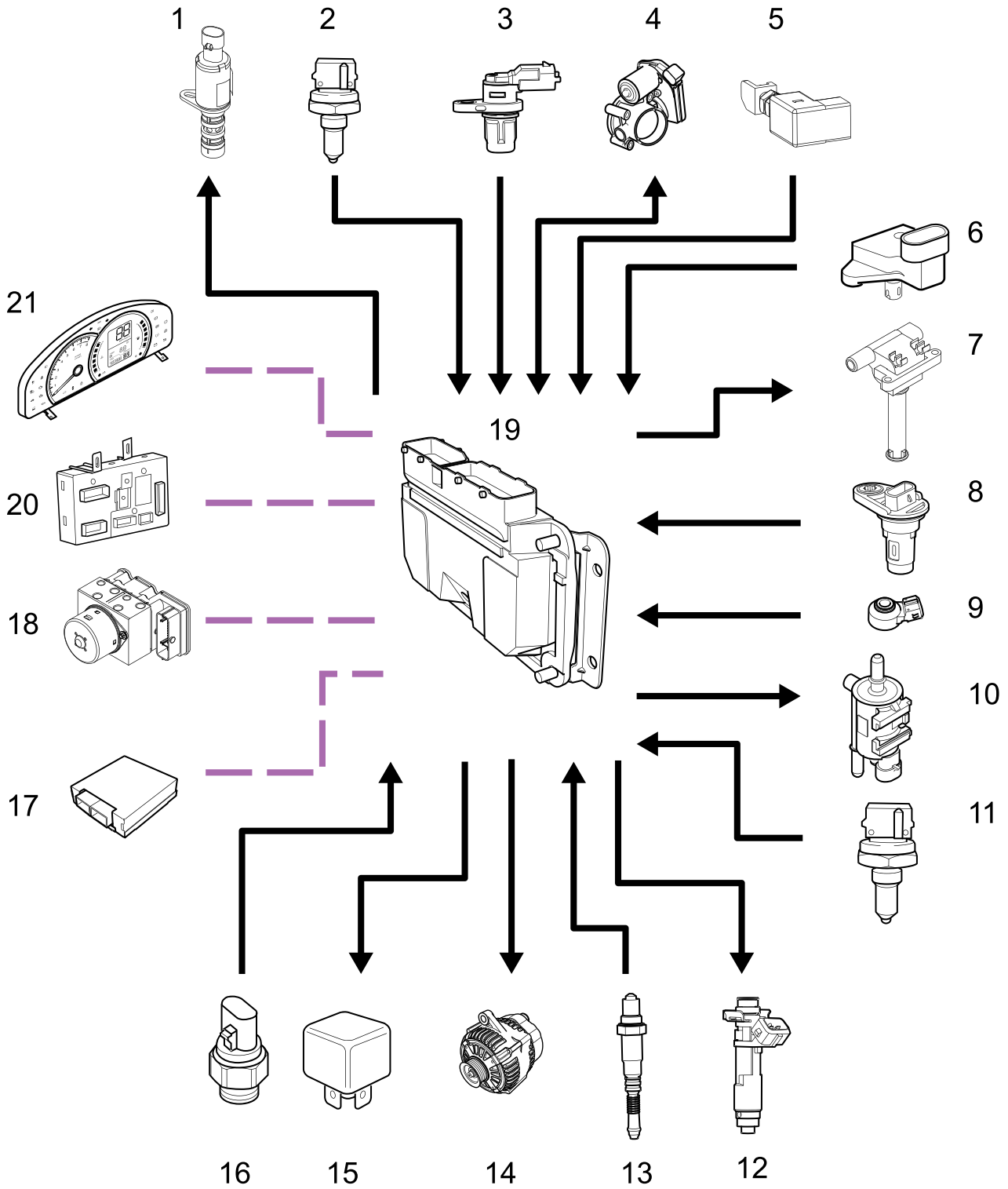


- 1. Water Temperature Sensor
- 2. Intake Pressure/Temperature (TMAP) Sensor
- 3. Knock Sensor
- 4. Oil Pressure Switch

- 5. Camshaft Position (CMP) Sensor
- 6. Oxygen Sensor
- 7. Crankshaft Position (CKP) Sensor

System Control Diagram

Engine Control System Control Diagram



- 1. Variable Cam Timing Valve
- 2. Oil Temperature Sensor
- 3. Phase Sensor
- 4. Electronic Throttle Valve

- 5. Brake Pedal Switch
- 6. Intake Pressure/Temperature Sensor
- 7. Ignition Coil 1, 2
- 8. Engine Speed Sensor

-
- | | |
|--------------------------------------|---|
| 9. Knock Sensor | 16. A/C Pressure Sensor |
| 10. Canister Control Valve | 17. Transmission Control Module (TCM) (Only for Automatic Transmission Case) |
| 11. Engine Coolant Sensor | 18. DSC(ABS) Modulator |
| 12. Injector 1 - 4 | 19. Engine Control Module (ECM) |
| 13. Heated Oxygen Sensor HO2S | 20. Body Control Module (BCM) |
| 14. Alternator | 21. Instrument Pack |
| 15. Cooling Fan Relay Unit | |

Description

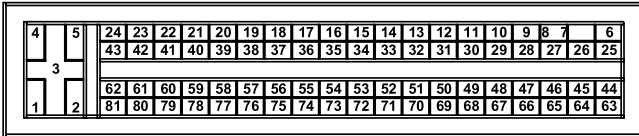
General Description

Engine management system (**ECM**) is used to control every aspect of the engine operation. The system receives the input from every kind of sensors and use it to determine the output (including the fuel amount delivered to combustion chamber, ignition time and boost control, etc.). The NSE engine uses the BOSCHME 7.9.7.1 **IECM**. This is a continuous type, multiport fuel injection system and it is controlled by the **ECM**, and adopts speed/density theory which combines the electronic throttling control. **ECM**The purpose of the engine management system control is: improving the engine power performance, reducing the fuel consumption and decreasing the exhaust contamination.

Engine Control Module (ECM)

The engine control module is the control centre of the fuel injection system. It continuously monitors the information from each sensor, and controls each system that affects the vehicle performance. It also performs the system diagnosis function. It can identify the operation malfunction, and remind the driver by using the malfunction indicator lamp (**MIL**) and store the diagnostic trouble code indicating the trouble areato ease repair by the repairer.

ECM Wire Harness Connector End View



Connector Pin Detailed Information Chart

| Pin No. | Description |
|---------|--------------------------------|
| 1 | Upstream Oxygen Sensor Heating |
| 2 | Ignition Coil 2 |
| 3 | Ignition Ground |
| 4 | Empty |
| 5 | Ignition Coil 1 |
| 6 | Injector 4 (No.1 cylinder) |
| 7 | Injector 2 (No.4 cylinder) |
| 8 | Empty |
| 9 | Empty |
| 10 | Empty |
| 11 | Empty |
| 12 | Constant Power Supply |
| 13 | Ignition Switch |
| 14 | Main Relay |
| 15 | Engine Speed Sensor |

| | |
|----|--|
| 16 | Accelerator Pedal Module Signal |
| 17 | Sensor 1 |
| 18 | Upstream Oxygen Sensor Signal |
| 19 | Knock Sensor End A |
| 20 | Knock Sensor End B |
| 21 | Stop Lamp |
| 22 | Empty |
| 23 | Brake Vacuum Pump Sensor (Only for AT model) |
| 24 | Empty |
| 25 | Empty |
| 26 | Empty |
| 27 | Injector 1 (No.3 cylinder) |
| 28 | Downstream Oxygen Sensor Heating |
| 29 | Empty |
| 30 | Electronic Vacuum Pump (Only for AT model) |
| 31 | Empty |
| 32 | 5V Power Source 2 |
| 33 | 5V Power Source 1 |
| 34 | Empty |
| 35 | Sensor Ground 3 |
| 36 | Sensor Ground 2 |
| 37 | Intake Pressure Sensor |
| 38 | Electronic Throttle Body |
| 39 | Engine Coolant Temperature Sensor |
| 40 | Accelerator Pedal Module Signal |
| 41 | Empty |
| 42 | Intake Air Temperature Sensor |
| 43 | Empty |
| 44 | Power Source Passing through the Main Relay |
| 45 | Power Source Passing through the Main Relay |
| 46 | Canister Valve |
| 47 | Injector 3 (No.2 cylinder) |
| 48 | Variable Camshaft Timing (Intake) |
| 49 | Empty |
| 50 | Low Speed Cooling Fan Relay |

| | |
|----|---|
| 51 | Electronic Ground 2 |
| 52 | Empty |
| 53 | Electronic Ground 1 |
| 54 | Electronic Throttle Body |
| 55 | Downstream Oxygen Sensor Signal |
| 56 | Oil Temperature Sensor |
| 57 | Empty |
| 58 | Brake Switch |
| 59 | Generator Control Input |
| 60 | Air Conditioning Medium Pressure Switch |
| 61 | Power Ground 1 |
| 62 | CAN Bus Interface |
| 63 | Power Source Passing through the Main Relay |
| 64 | Throttle Actuator |
| 65 | Throttle Actuator |
| 66 | Throttle Actuator |
| 67 | Throttle Actuator |
| 68 | High Speed Cooling Fan Relay |
| 69 | Air Conditioner Compressor Relay |
| 70 | Fuel Pump Relay |
| 71 | Diagnosis K Line |
| 72 | Empty |
| 73 | Input Power Source for Immobilizer System |
| 74 | Clutch Switch |
| 75 | Air Conditioning Switch |
| 76 | Empty |
| 77 | Empty |
| 78 | Sensor Ground 4 |
| 79 | Camshaft Position Sensor |
| 80 | Power Ground 2 |
| 81 | CAN Bus Interface |

The engine management system can be divided into six parts according to the control theory, corresponding to the "Engine Management System - 1.5 L (I) - (6)" for the repair wiring diagram.

They are:

- External Control
- Engine Air Supply Control System

- Engine Ignition Control System
- Engine Fuel Supply Control System
- Accessory 1 (Thermal Management)
- Accessory 2 (External Auxiliary)

External Control

The engine external control mainly contains:

- Main Relay
- Ignition Switch
- Battery
- **CAN** Communication
- Immobilizer System Power Supply

The external control mainly contains power supply and communication. The power source of the engine control module (**ECM**) has a circuit connected to the power source directly through the fuse EF23, in order to make sure the power is supplied to the **ECM**. When the ignition switch is in ON or ING position, the engine control module can control the turning on of the main relay or the connection to the ignition power source.

The engine control can communicate with the controllers on the other network nodes through the high speed**CAN** to guarantee each performance of the system. It can also be connected to the diagnostic interface (DLC) in order to easy perform the diagnosis operation by repairer.

Main Relay

The main relay is the relay R3 that is located in the engine bay fuse box. It is a 4-pin relay which uses DIN pin layout. This relay does not have a reverse protection diode, and this function is performed by the **ECM**. The resistance of the relay coil is 84 to 124 Ω (±10%), controlled by the **ECM**.

When the engine control module (**ECM**) detects the ignition switch is in IGN position, outputs low level signal, turns on the control relay, and applies power supply voltage to the UBR pins (44, 45, 63) of **ECM**, to make sure the start conditions are satisfied.

Malfunction

The main relay error may occur due to the following conditions:

- Short in Relay Winding
- Open in Relay Winding
- Relay Winding Resistance High
- The relay contact point is normal open
- The relay contact point is normal close
- Relay Contact Point Resistance High
- Open in Relay Wire Harness

- Relay Wire Harness Resistance High
- Relay Wire Harness Short to 12 V Power Source
- Relay Wire Harness Short to Ground
- **ECM** does not provide grounded circuit

Perform the following inspection to determine if the main relay operates normally:

- Check sound - Check if the fuel pump operates for 2 seconds after the ignition key is turned to the on (IG) position? (Perform this check by hearing the "beep" sound produced by the fuel flowing near the fuel pump)
- Check if there is power supplied to the injector or ignition coil? (Check the battery voltage using the multimeter)

If the items above are detected, it indicates that the main relay operates normally.

CAN Communication

The engine management system uses the high speed **CAN** communication network to realize the communication between the **ECM** and **ABS**, **BCM**, TCU, and diagnoses output through the diagnostic interface.

Immobilizer System Power Supply

When the ignition switch is turned to the second shift, the engine control module (**ECM**) and the body control module (**BCM**) communicate with each other via the **CAN** high speed bus line, when the information is verified by each other and passed, the **BCM** controls the starter motor operation, **ECM** controls the ignition, injection and engine starting. The No.73 pin of the **ECM** is used to supply power to the immobilizer system. If the wire harness for the pin is disconnected, and 5 V power supply from the No.32 pin is not available, then the engine immobilizer system will not operate, **BCM** cannot receive the verification from the **ECM**, the starter motor as well as the engine also cannot operate.

Engine Air Supply Control System

The engine air supply control system mainly contains:

- Electronic Throttle Body
- Accelerator Pedal Module
- Intake Pressure Temperature Sensor
- Camshaft Position Sensor
- Variable Camshaft Timing Valve

When the air-fuel ratio is 14.7:1, the fuel can be burned sufficiently, then the engine achieves the optimal operation state.

The air supply control system mainly controls the intake air volume and the master stroke of the oil cylinder to achieve the optimal air-fuel ratio.

Electronic Throttle Valve

The electronic throttle valve consists of throttle valve, throttle valve driver (DC motor) and throttle position sensor, etc.

The command from the **ECM** makes the DC motor operate, which changes the throttle valve opening angle with the linkage. Two potentiometers, which are opposite-phase fitting, function as position sensors. When the throttle position changes, the resistances of two circuits change linearly, one increases while the other decreases. When 5 V voltage is provided, it converts into the voltage output which changes according to the resistance value.

The two potentiometers described above together with another two, which are fitted on the accelerator pedal module to monitor the accelerator pedal stroke form a part of the monitor function of the electronic throttle control system, which can offer redundancy protection expected by the system control.

Throttle Position Sensor

The throttle position sensor is used to send information about the throttle valve angle to the **ECM**. **ECM** Based on this information, **ECM** can attain the information of engine load and operating condition (such as starting, idling, motoring, partial load and full load), as well as information of acceleration and deceleration.

Actually, the throttle valve sensor is a angle potentiometer with linear output characteristic. The potentiometer swivel arm and the throttle valve are fitted coaxially, when the throttle valve turns, it drives the potentiometer swivel arm slide to a certain position, and the potentiometer outputs voltage signal which is proportion to the throttle valve position.

Accelerator Pedal Module

Two potentiometers in the accelerator pedal module function as sensors, both resistance values vary according to the position of the electronic accelerator pedal. **ECM** can make an accurate response to the movement of the accelerator pedal, thus monitoring the movement of the accelerator pedal can be possible.

Since the two potentiometers are in-phase fitting, their resistances linearly increase or decrease when the accelerator pedal position changes. When 5 V power supply is provided, it converts into the voltage output which changes according to the resistance value. The two potentiometers described above together with another two, which are fitted on the electronic throttle valve to monitor the throttle valve position form a part of the monitor function of the electronic throttle control system, which can offer redundancy protection expected by the system control.

Intake Pressure Temperature Sensor (TMAP)

The intake pressure temperature sensor detects the intake manifold absolute pressure and the intake air temperature, offers the engine load and intake air temperature information.

The sensor detecting the intake pressure is a piezoelectric type sensor, which can provides the controller with the "load signal" according to the difference between the atmosphere pressure and the intake manifold absolute pressure; the controller provides 5 V voltage, and feedbacks 0 to 5 V voltage to the controller in accordance to the intake pressure. The sensor detecting the intake air temperature is a NTC type (negative temperature coefficient) sensor, the resistance changes in accordance with the intake air temperature, this sensor transmits a voltage indicating intake temperature changes to the controller. The pressure P is in direct proportion to the output voltage, and the temperature is in inverse proportion to the output resistance.

Camshaft Position (CMP) Sensor

If there is no distributor, the camshaft position sensor is used with the speed sensor, in order to provide the **ECM** with the crankshaft phase information, which is used to distinguish the compression top dead centre and exhaust top dead centre of cylinder 1.

The camshaft position sensor consists of a hall sensor and a rotor made of steel sheet. The hall sensor is fixed, the rotor is fitted on the camshaft, and there is a boss with 36° curvature on the rotor. When the boss passes through the hall sensor, the internal magnetic field in the hall sensor changes, resulting in the variation of output signal voltage. Therefore, two different dead centres can be distinguished.

Malfunction

CMP sensor or magnetic ring may malfunction or provide incorrect signals due to the following conditions:

- The air gap of the **CMP** sensor is not as specified
- The **CMP** sensor is contaminated by the metal debris
- The **CMP** sensor hall-effect semiconductor is damaged
- The magnetic field of the **CMP** sensor is too weak
- Open in **CMP** Sensor Wire Harness
- Short in **CMP** Sensor Wire Harness
- **CMP** Sensor Wire Harness Resistance High
- The magnetic ring is contaminated by the metal debris
- The accuracy of the magnetic ring is poor due to the mechanical damage
- Exhaust Camshaft Timing Error
- Intake Camshaft Timing Error

Oil Temperature Sensor

The oil temperature sensor (EOT) monitors the engine oil temperature and controls the variable camshaft timing valve (VCT valve). Adjust the variable camshaft timing valve at different temperatures to achieve the optimal intake air volume.

Malfunction

The EOT sensor may malfunction or provide incorrect signals due to the following conditions:

- System Oil Starvation
- Open in External Wire Harness
- External Wire Harness Short to Ground
- External Wire Harness Short to the 5 V Power Supply
- External Wire Harness High Resistance
- **ECM** cannot provide grounded circuit
- Damage of the EOT Sensor Thermistor

Variable Cam Timing Valve (VCT)

The engine control module outputs pulse width modulation (PWM) signal to drive the solenoid valve, the opening angle of the solenoid valve is adjusted by changing the duty ratio.

When the engine speed is low, the VCT system can reduce the fuel consumption and improve the engine performance during exhaust emission, especially the torque performance.

ECM receives signals from the **CKP** sensor and **CMP** sensor. Using these signals, **ECM** determines the valve timing by referring to the control diagram. Then the **ECM** operates the VCT oil control valve fitted on one side of the cylinder head. These solenoid valves control the oil flowing into the phase modulator, changes the position of the phase modulator in relation to camshaft, thus adjusting the valve timing.

Engine Ignition Control System

The engine ignition control system mainly contains:

- Ignition Coil 1, 2
- Engine Speed Sensor
- Knock Sensor
- Firing Order

Ignition Coil

The ignition coil converts the DC low-voltage power into the high-voltage power, and the sparks occur by the spark plug discharge to ignite the fuel and air mixture in the cylinder. Each ignition coil contains a pair of coil windings around the laminated core, the primary coil resistance is 0.7 Ω, and the secondary coil resistance is 10 kΩ.

Two ignition coils are fitted on the camshaft cover. They are fitted on the No.1 and No.3 cylinders, and connected to the ignition coil and camshaft sensor wire harness by using the

connector. There is a spark plug connected to underside of each coil, and the coil is connected to another spark plug through the high-voltage (HT) wiring.

The coil fitted on the No.1 cylinder is connected to the spark plug of the No.1 cylinder while the HT wiring is connected to the spark plug of the No.4 cylinder. The coil fitted on the No.3 cylinder is connected to the spark plug of the No.3 cylinder while the HT wiring is connected to the spark plug of the No.2 cylinder.

Malfunction

The ignition coil error may occur due to the following conditions:

- Open in Primary Winding
- Short in Primary Winding
- The resistance of the primary winding is beyond the tolerance
- Open in Secondary Winding
- Short in Secondary Winding
- Secondary winding is connected, and the primary winding is short
- The resistance of the secondary winding is beyond the tolerance
- The insulation on the coil top is suffered mechanical damage

Crankshaft Position (CKP) Sensor

The **CKP** sensor offers the engine speed information and crankshaft top dead centre information in ignition system without distributor. It is a hall-effect sensor that can be used with the signal plate. The signal plate is a teeth plate, the small teeth on the magnetic ring are arranged with an interval of 6°, there are 58 small teeth, with a gap of 2 teeth. The signal plate is fitted on the crankshaft and rotates with the crankshaft. When the tooth tip travels through along the end of the sensor, the signal plate made of ferromagnetic material cuts the magnetic line of force for the permanent magnet in the sensor, so that the induction voltage is generated in the coil and output as the speed signal.

Malfunction

CKP sensor or magnetic ring may malfunction or provide incorrect signals due to the following conditions:

- The air gap of the **CKP** sensor is not as specified
- The **CKP** sensor is contaminated by dirt
- The **CKP** sensor hall-effect semiconductor is damaged
- The magnetic field of the **CKP** sensor is too weak
- Open in **CKP** Sensor Wire Harness
- Short in **CKP** Sensor Wire Harness
- **CKP** Sensor Wire Harness Resistance High

- Magnetic ring is contaminated by dirt
- The accuracy of the magnetic ring is poor due to corrosion or mechanical damage
- **CKP** sensor signal distort due to the distortion of flywheel or drive plate
- **CKP** sensor signal changes due to the crank radial displacement

To check whether the **ECM** receives the signal from the **CKP** sensor or not, the following operations can be performed:

- Check the fuel pump operation while the engine starting. During the engine starting, if the fuel pump supplies fuel when the ignition switch is turned on but the engine is not running, it indicates that the **ECM** does not receive the signal from the **CKP** sensor.

Knock Sensor

The knock sensor is used to provide the electronic controller **ECM** with the engine knock information and perform the knock control.

The knock sensor is a vibration acceleration sensor. It is fitted on the engine cylinder block. The sensing element of the sensor is a piezoelectric crystal. The vibration of the engine cylinder block is transmitted to the piezoelectric crystal through the mass block in the sensor. The piezoelectric crystal suffers the pressure caused by the mass block vibration, generates voltage on the two poles and converts the vibration signal into voltage signal to output.

Malfunction

Knock sensor may malfunction or provide incorrect signals due to the following conditions:

- Open in Sensor
- Sensor Short to Ground
- Intermittent Open in Sensor
- Incorrect Refit of the Knock Sensor

If a malfunction occurs in the knock sensor, the following symptoms may appear:

- trouble code is stored
- **ECM** does not detect the engine combustion knock
- **ECM** restore the default setting

Engine Fuel Supply Control System

The engine fuel supply control system mainly contains:

- Upstream Oxygen Sensor
- Downstream Oxygen Sensor
- Injector 1-4
- Canister Valve
- Fuel Pump Relay

The engine fuel supply control system mainly controls the amount of the oil supplied to the engine according to the operation conditions.

When the engine starts for the first time and the engine speed is higher than the preset speed, the system starts the open loop operation. The control module ignores the signal from the heated oxygen sensor (**HO2S**). The control module calculates the air-fuel ratio based on the input signals from the **ECT, TMAP** and **TP** sensor. The system will maintain the open loop state until the following conditions are met:

- **HO2S** output voltage changes, it displays the **HO2S** has increased to a level that is enough to operate normally
- **ECT** sensor temperature is higher than the specified temperature
- A specified time has elapsed since the engine starts

For above conditions, each engine has its specified value, and they are stored in the electrically erasable programmable read only memory (**EEPROM**). When these values are satisfied, the system starts the closed loop operation. During the closed loop operation, the control module calculates the air-fuel ratio and the injector opening time based on the signals from each sensor, especially the heated oxygen sensor. Thus, the air-fuel ratio is always very close to 14.7:1.

Oxygen Sensor

The oxygen sensor detects the oxygen content in the engine exhaust in order to determine if the gasoline and the air are burned completely. Based on this information, the electronic controller achieves the closed loop control, which set the excess air coefficient $\lambda = 1$ as the target, in order to insure the three-way catalytic converter keeps the maximum conversion efficiency for the three kinds of contamination (**HC, CO** and **NOx**).

Its sensing element is a ceramic tube, the outside is connected to the exhaust while the inside is connected to the air. When the temperature of the sensing ceramic tube reaches 350°C, it has the characteristic of the solid state electrolyte. Based on this characteristic, the oxygen density difference is converted into the electric potential difference, causing the electric signals output. If the mixture is rich, the difference between the inner and outer oxygen ion density of the ceramic tube is higher, and the electric potential is higher, a large amount of oxygen ion moves from inside to outside, the output voltage (approximately 900 mV) is higher; if the mixture is lean, the difference between the inner and outer oxygen ion density of the ceramic tube is lower, and the electric potential is lower, a little of oxygen ion moves from inside to outside, the output voltage (approximately 900 mV) is lower.

The oxygen sensors can be divided into front and rear oxygen sensor, the front oxygen sensor is used to determine the

oxygen content in the engine exhaust to realize the closed loop control; the rear oxygen sensor is used to monitor the conversion function of the three-way catalyst.

Malfunction

HO2S may malfunction or provide incorrect signals due to the following conditions:

- Contaminated by Leaded Fuel
- Contaminated by Carbon or Silicone Sediment
- Collision Damage/Mechanical Collision
- Open in External Wire Harness
- External Wire Harness Short to the 12 V Power Supply
- External Wire Harness Short to Ground
- External Wire Harness High Resistance
- Open in Heater Unit
- Short in Heater Unit
- **ECM** does not provide grounded circuit to the heater unit
- The screened wire is not connected to the ground

Fuel Injectors

The injector injects fuel in the specified time according to the commands from the **ECM**, to supply the fuel to the engine and atomizes it. **ECM** applies power to the coil of the injector, forming the magnetic field force. When the magnetic field force increases to a level that is enough to cancel out the composition of the return spring compression pressure, gravity force and friction force of the needle valve, the needle valve starts to rise to inject the fuel. When injection pulse is stopped, the return spring compression force recloses the needle valve.

Malfunction

The injector error may occur due to the following conditions:

- The nozzle is contaminated by dirt or wax (The fuel injection volume declines)
- The nozzle is misaligned (The injection is not positioned correctly)
- The fuel filter is blocked
- Open in Winding
- Winding Short to Ground
- Winding Short to the 12 V Power Supply
- The resistance of the winding is beyond the tolerance
- Open in External Wire Harness
- External Wire Harness Short to Ground
- External Wire Harness Short to the 12 V Power Supply

Power Fuel Pump

The power fuel pump transmits the fuel from the tank to the engine, and provides enough fuel pressure and sufficient fuel.

The power fuel pump, built into the fuel tank, is a vane pump driven by the DC motor, immersed in the fuel and cooled and lubricated by the fuel. The battery supplies power to the power fuel pump through the fuel pump relay, the power fuel pump circuit is switched on only when the relay is on and the engine is running. When the engine stops running due to an accident, the fuel pump operation will automatically stop.

Malfunction

The inertia switch supplies the 12 V power source to the fuel pump, the connection to the **BCM** offers the information about the fuel pump circuit condition. The resistance of the fuel pump relay coil is 155 Ω ($\pm 10\%$). If the fuel pump relay error occurs, the following symptoms may appear:

When the engine is started:

- If the pressure of the fuel system is dropped to 0, the engine ignition cannot be performed
- If the pressure of the fuel system is lower than the normal operation pressure (3.8 bar), the engine ignition may try to be performed, but cannot operate normally.
- If the pressure of the fuel system is normal, the engine ignition will operate. However, the engine will stall finally with the fuel pressure decreasing and does not start again.

When driving

If the fuel pump relay error occurs during driving, the engine will lose power, and stall finally due to the lack of fuel.

The fuel pump relay error may occur due to the following conditions:

- Short in Relay Coil
- Open in Relay Coil
- Relay Coil Resistance High
- The relay contact point is normal open
- The relay contact point is normal closed
- Relay Contact Point Resistance High
- Open in Relay Wire Harness
- Relay Wire Harness Resistance High
- Relay Wire Harness Short to 12 V Power Source
- Relay Wire Harness Short to Ground
- **ECM** cannot provide grounded circuit

Perform the following inspection to check if the fuel pump relay operates normally:

- Check sound - Check if the fuel pump operates for 2 seconds after the ignition key is turned to the ON (IG) position? (Perform this check by hearing the "beep" sound produced by the fuel flowing near the fuel pump)
- If no response occurs, check the inertia switch to ensure that there is no unexpected trigger. If the fuel pump operation is not shown, but the inertia switch is turned to "ON" position, then remove the fuel pump relay and check it.

During the ignition key has been turned to the ignition ON position for 2 seconds and the engine is started, check for the **ECM** provides grounded circuit for the fuel pump relay winding. Remove the fuel pump relay, connect the multimeter between the 12 V power source supplied by the vehicle and the fuse box pin that connected with fuel pump pin 85. After the ignition is on, check the output according to the wiring diagram.

The measured voltage may be lower than the battery voltage since the **ECM** internal drive circuit will discharge certain voltage.

Canister Control Valve

The canister control valve is used to control the airflow volume regenerated by the fuel evaporation control system.

The canister in the fuel evaporation control system absorbs the fuel vapor from the fuel tank until it becomes saturated. **ECM** controls the opening of the canister control valve, the refresh air and the saturated fuel vapor in the canister form the regenerative airflow, which is guided into the engine intake pipe again. The electronic controller changes the duty ratio of the pulse signal that is sent to the canister control valve solenoid coil, thus controlling the regenerative airflow volume. In addition, the flow will also be affected by the pressure difference of the both ends.

Malfunction

The canister control valve error may occur due to the following conditions:

- Open in Magnetic Winding
- Short in Magnetic Winding
- External wire harness short to the 12 V power supply
- External Wire Harness Short to Ground
- External Wire Harness High Resistance
- **ECM** does not offer the **PWM** signal
- The mechanical problem occurs in the valve

Accessory I (Thermal Management)

The thermal management part mainly contains:

- Air Conditioner Compressor Relay
- Air Conditioner Request (Switch)

- Coolant Temperature Sensor
- Cooling Fan Relay (Low Speed, High Speed)
- A/C Pressure Sensor

The engine adjusts the opening or closing of the high speed and low speed fan relays according to the coolant temperature.

While the driver presses the air conditioner request (switch) on the instrument panel, the engine control module monitors the condition of the air conditioner pressure sensor signal, and determines if the air conditioner is turned on according to the signal from the engine coolant temperature sensor and the engine speed signal, etc.

Air Conditioner Compressor Relay

When the relay controlled by the **ECM** is energized, it supplies battery voltage to the **A/C** compressor clutch circuit under the following conditions:

- **A/C** system offers the **A/C** request
- The engine speed is more than 500 rpm
- The state of the air conditioner pressure sensor
- The evaporator temperature is above -7°C (19°F)
- The throttle valve opening angle is less than 85°
- The engine temperature is lower than 118°C (244°F)

Coolant Temperature Sensor

The coolant temperature sensor is used to offer the engine coolant temperature information, so that the controller can correct the injection and ignition according to the information. It is a thermistor with negative temperature coefficient (**NTC**), the resistance value decreases as the temperature increases, but it is not linear relationship. This thermistor is fitted in a copper heat conduction sleeve.

Malfunction

ECT sensor may malfunction or provide incorrect signals due to the following conditions:

- The system lacks of coolant due to leakage
- Open in External Wire Harness
- External Wire Harness Short to Ground
- External Wire Harness Short to the 5 V Power Supply
- External Wire Harness High Resistance

- **ECM** cannot provide grounded circuit
- Damage of **ECT** Thermistor

Cooling Fan Relay Unit

The cooling fan relay unit, which is equipped with two relays, is fitted on the left side of the radiator.

The cooling fan is controlled by the **ECM** and handled by the relay unit. **ECM** use the information offered by the **ECT** sensor, **BCM** and **A/C** pressure sensor to restrict the engine coolant temperature.

This fan strategy includes the adjustment for the engine idling to compensate for the additional load when the fan is switched on. After the ignition key is removed, the cooling fan can continue operating for 5 minutes to cool the high temperature engine.

Accessory 2 (External Auxiliary)

The external auxiliary part mainly contains:

- Alternator Control Input
- Clutch Switch
- Brake Pedal Switch
- Stop Lamp

Alternator Control Input

Alternator control input is used by **ECM** to control the alternator, so that the battery can be charged when the engine is operating.

Brake Switch

The brake switch is located on the pedal box in the driver's compartment. **ECM** monitors the status of the switch and transmits the data to the **TCM** via the **CAN** bus line. **TCM** controls the transmission case clutch to open. When the brake pedal is being operated, the brake switch is activated. For more details, refer to the "Brake" section.

Clutch Switch (only for Manual Transmission)

Both the clutch switch and the brake switch are fitted on the pedal assembly. When the clutch pedal is being operated, the clutch switch is activated. For more details, refer to the "Clutch" section.

Service Procedures

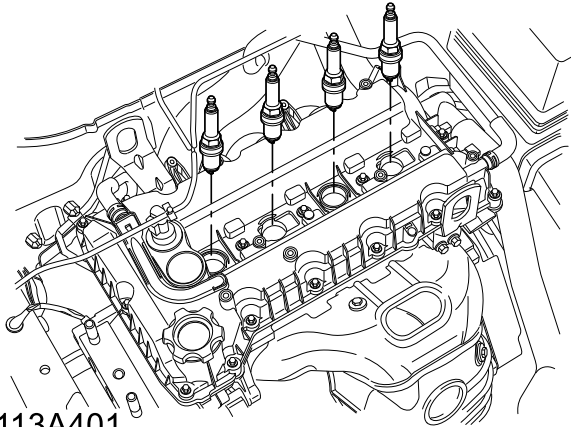
Spark Plug

Removal

1. Disconnect the battery earth lead.
2. Remove the ignition coil and the high tension cord.

 **Ignition Coil**

3. Clean the area around the spark plug, and blow off the dirt around the spark plug with high pressure air.
4. Using the spark plug socket, remove the 4 spark plugs.



S113A401

Refit

1. Adjust each new spark plug gap to a value between 0.80 mm and 0.90 mm.
2. Fit the spark plugs and tighten to **20-30 Nm**.
3. Fit the ignition coil.

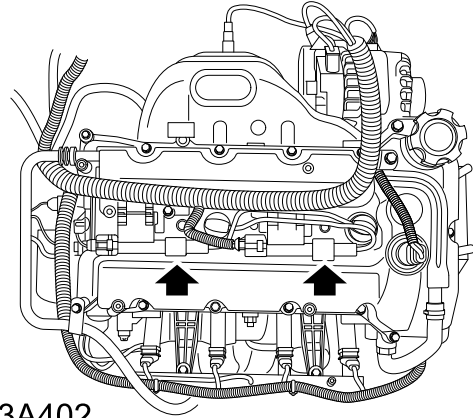
 **Ignition Coil**

4. Connect the battery earth lead.

Ignition Coil

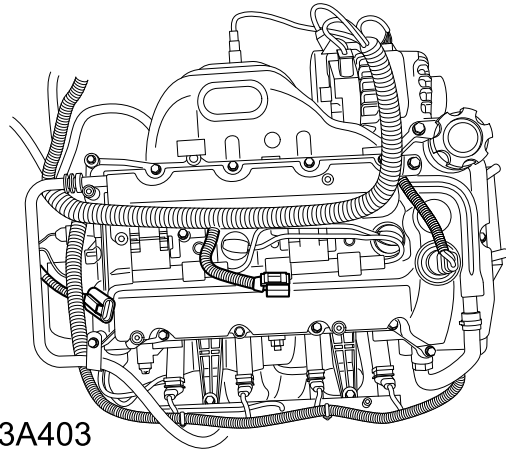
Removal

1. Disconnect the battery earth lead.
2. Loosen the secondary wiring.



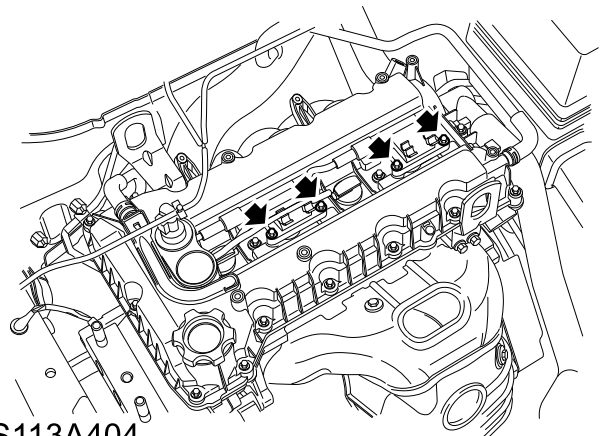
S113A402

3. Disconnect the wire harness connector terminal.



S113A403

4. Remove the bolts and nuts securing the ignition coil.



S113A404

5. Hold the root of the ignition coil rubber gaiter, and pull the ignition coil out of the spark plug.

Refit

1. Connect the secondary wiring to the ignition coil. Cylinder 1 is connected to cylinder 4 and cylinder 2 is connected to cylinder 3.

2. Fit the ignition coil to the spark plug, and connect the wire harness connector terminal.

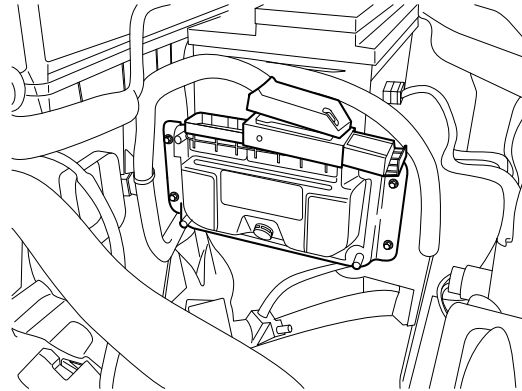
Caution: *There is a bracket between the ignition coil and the camshaft housing cover.*

3. Tighten the bolts securing the ignition coil to **8–12 Nm**
4. Connect the secondary wiring to the spark plug.
5. Connect the battery earth lead.

Engine Control Module (ECM)

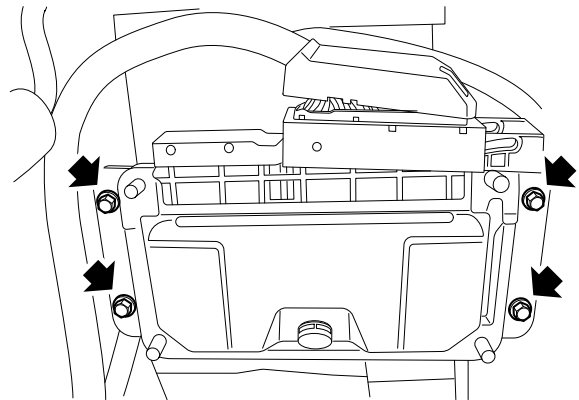
Removal

1. Disconnect the battery earth lead.
2. Disconnect the connector from the **ECM**.



S131A401

3. Remove the nuts and bolts securing the **ECM** to the battery support.



S131A402

4. Remove the **ECM** from the bracket.

Refit

1. Position the **ECM** and align the mounting hole with the battery support.
2. Fit the nuts and bolts securing the **ECM** to the bracket and tighten them to **8-10 Nm**.
3. Secure the wire harness and connect it to the **ECM** connector.
4. Connect the battery earth lead.
5. Using the scan tool, initialize the **ECM**.

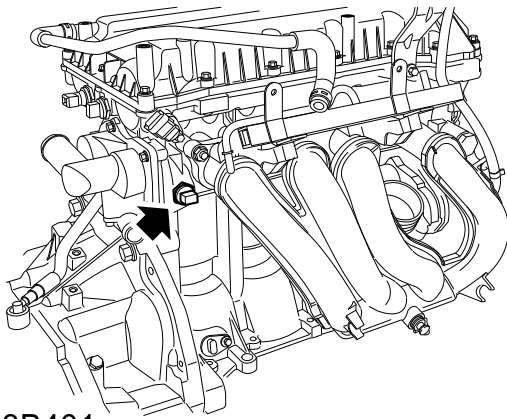
Engine Coolant Temperature Sensor (ECT)

Removal

1. Disconnect the battery earth lead.
2. Unscrew the coolant expansion tank cover to discharge the cooling system pressure, and then fit the cover.

Warning: *Since injury such as scalding could be caused by escaping steam or coolant, DO NOT open the expansion tank cap while the cooling system is still hot.*

3. Disconnect the wire harness connector terminal.
4. Place a proper container to collect the overflowing coolant.
5. Remove the engine coolant temperature sensor.



S113B401

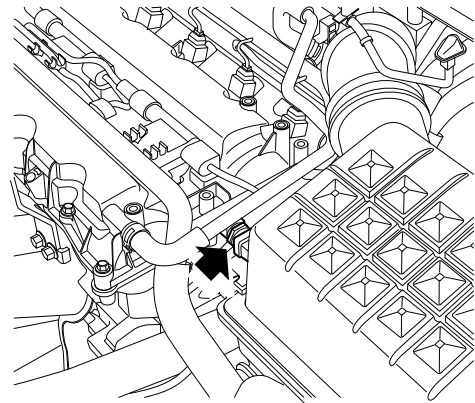
Refit

1. Clean the threads of the coolant temperature sensor.
2. Fit the new seal washer to the coolant temperature sensor.
3. Fit the engine coolant temperature sensor and tighten to **14–18 Nm**.
4. Connect the wire harness connector terminal of the engine coolant temperature sensor.
5. Connect the battery earth lead.
6. Check the coolant level, and fill if necessary.

Engine Oil Temperature Sensor

Removal

1. Disconnect the battery earth lead.
2. Disconnect the wire harness connector terminal from the oil temperature sensor.
3. Place the oil receiver under the switch to collect the overflowing oil.
4. Remove the oil temperature sensor.



S113B402

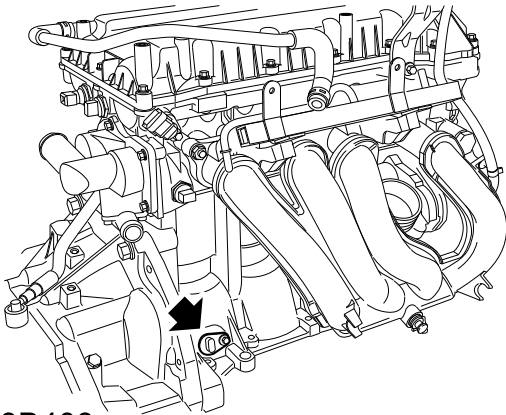
Refit

1. Clean the threads of the oil temperature sensor.
2. Fit the new seal washer to the oil temperature sensor and tighten the switch to **14–18 Nm**.
3. Connect the oil pressure switch wire harness connector terminal.
4. Remove the oil receiver.
5. Connect the battery earth lead.
6. Check the engine oil level, and fill if necessary.
7. Connect the battery earth lead.

Crankshaft Position Sensor

Removal

1. Disconnect the battery earth lead.
2. Raise the vehicle on a lift.
3. Disconnect the wire harness connector terminal from the crankshaft position sensor.
4. Remove the bolt securing the crankshaft position sensor to the cylinder block.
5. Remove the crankshaft position sensor.



S113B403

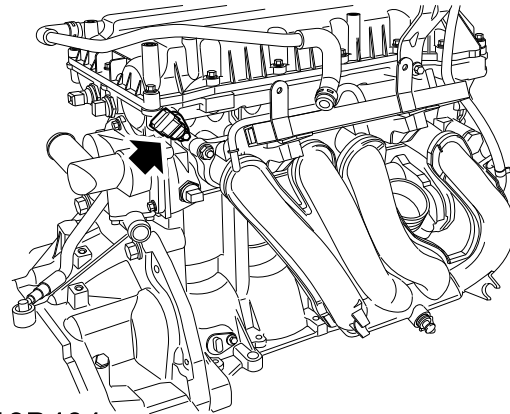
Refit

1. Clean the mating surface between the crankshaft position sensor and the cylinder block.
2. Position the crankshaft position sensor, fit the set bolt and tighten to **8-12 Nm**.
3. Connect the crankshaft position sensor wire harness connector terminal.
4. Lower the vehicle.
5. Connect the battery earth lead.

Camshaft Position Sensor

Removal

1. Disconnect the battery earth lead.
2. Disconnect the wire harness connector terminal from the camshaft position sensor.
3. Remove the bolts securing the camshaft position sensor, remove the camshaft position sensor, and dispose of the O-ring.



S113B404

Refit

1. Clean the camshaft position sensor and the mating surface, fit the O-ring to the camshaft position sensor.
2. Fit the camshaft position sensor to the cylinder head and tighten the bolts to **8-12 Nm**.
3. Connect the camshaft position sensor wire harness connector terminal.
4. Connect the battery earth lead.

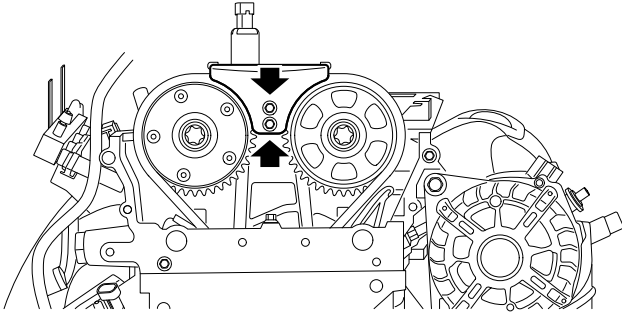
Camshaft Phase Modulator

Removal

1. Disconnect the battery earth lead.
2. Remove the timing chain.

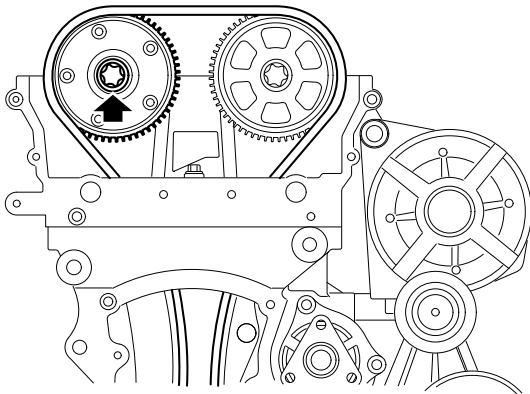
 **Timing Chain**

3. Remove the upper rail.



S111J413

4. Remove the camshaft phase modulator centre bolt and the camshaft phase modulator.



S111J421

Refit

1. Fit the bolts of the camshaft phase modulator, and tighten to **70-80 Nm**.
2. Fit the upper rail.
3. Fit the timing chain.

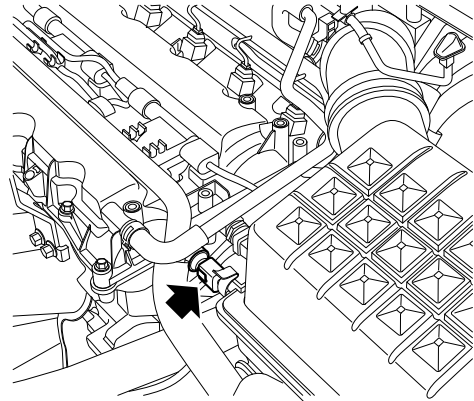
 **Timing Chain**

4. Connect the battery earth lead.

Oil Pressure Switch

Removal

1. Disconnect the battery earth lead.
2. Disconnect the wire harness connector terminal from the oil pressure switch.
3. Place the oil receiver under the switch to collect the overflowing oil.
4. Remove the oil pressure switch.



S113B405

Refit

1. Clean the threads of the oil pressure switch.
2. Fit the new seal washer to the oil pressure switch and tighten the switch to **14-18 Nm**.
3. Connect the oil pressure switch wire harness connector terminal.
4. Remove the oil receiver.
5. Connect the battery earth lead.
6. Check the engine oil level, and fill if necessary.

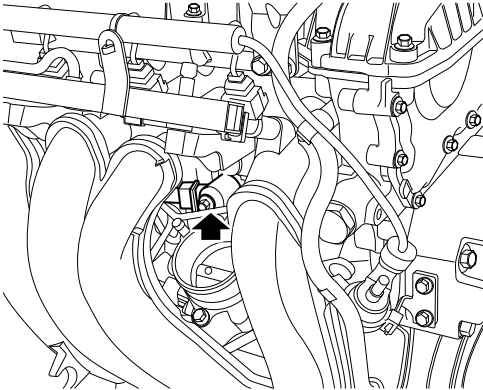
Knock Sensor

Removal

1. Disconnect the battery earth lead.
2. Remove the intake manifold.

Intake Manifold Gasket

3. Disconnect the wire harness connector terminal of the knock sensor.
4. Remove the bolts securing the knock sensor to the cylinder block, and remove the sensor.



S113B406

Refit

1. Clean the mating surface between the knock sensor and the cylinder block.
2. Fit the knock sensor, make sure that the wire routes correctly and tighten the bolts to **15-25 Nm**.
3. Connect the wire harness connector terminal of the knock sensor.
4. Fit the intake manifold and replace the gasket with a new one.
5. Connect the battery earth lead.

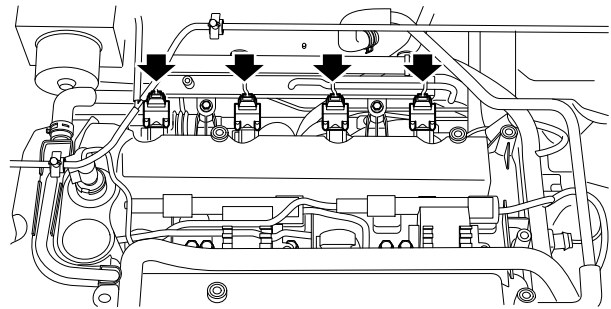
Fuel Rail

Removal

1. Disconnect the battery earth lead.
2. Discharge the fuel system pressure.

Warning: Fuel vapour is highly flammable, and it is also explosive and toxic in a confined space. There must have a fire extinguisher, such as foam, CO₂, gas or powder extinguisher when working on the fuel system or draining the fuel.

3. Disconnect the wire harness connector terminal from the fuel rail assembly.

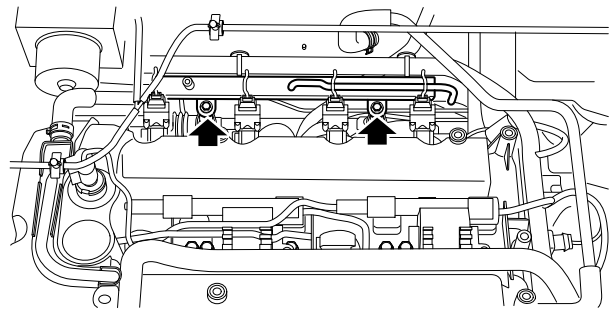


S113C401

4. Release the fuel inlet pipe from the fuel rail.

Caution: Plug the disconnected unions to prevent contamination entering.

5. Remove the 2 bolts securing the fuel rail to the intake manifold.



S113C402

6. Remove the fuel rail assembly.

Refit

1. Clean the injectors and the groove on the intake manifold.
2. Position the fuel rail assembly to the intake manifold, push each injector into the hole for each intake manifold.
3. Secure the fuel rail assembly to the intake manifold with

2 bolts and tighten to **8-12 Nm**.

4. Connect the fuel inlet pipe to the fuel rail.
5. Connect the wire harness connector terminal of the injector.
6. Connect the battery earth lead.

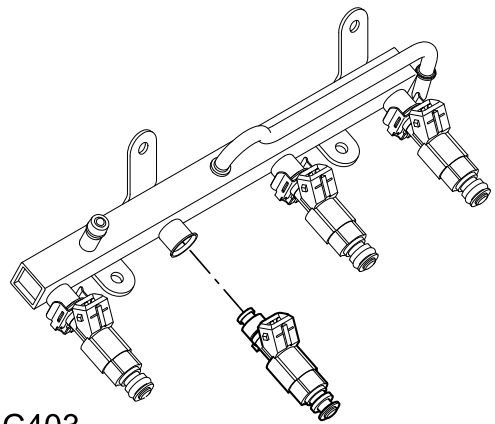
Injector

Removal

1. Disconnect the battery earth lead.
2. Disconnect the injector wire harness connector terminal.
3. Remove the fuel rail assembly.

 **Fuel Rail Assembly**

4. Loosen the spring clip securing the injector to the fuel rail and remove the injector.
5. Remove and dispose of the two O-rings on each injector.
6. Fit the caps to the end of each injector.



S113C403

Refit

1. Remove the cap from each injector.
2. Clean the injectors and the groove on the fuel rail.
3. Lubricate the new O-rings by using the oil and fit them to both ends of each injector.
4. Fit the injectors to the fuel rail.
5. Secure the injectors to the fuel rail with the spring clip.
6. Fit the fuel rail assembly.

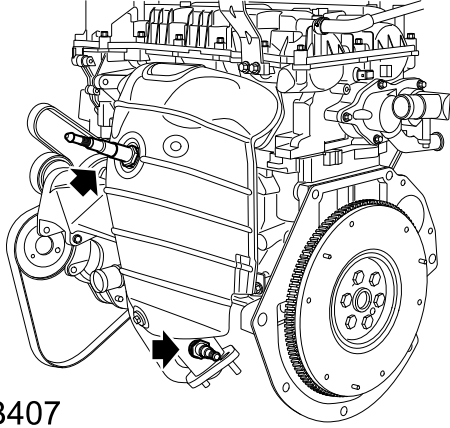
 **Fuel Rail Assembly**

7. Connect the injector connector wire harness.
8. Fit the battery earth lead.

Oxygen Sensor

Removal

1. Disconnect the battery earth lead.
2. Disconnect the oxygen sensor wire harness connector terminal.
3. Using the oxygen sensor replacer **TEN00011**, remove the oxygen sensor.



S113B407

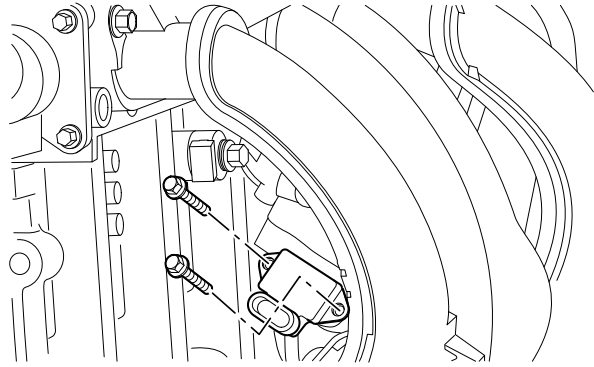
Refit

1. Using the oxygen sensor replacer **TEN00011**, fit the oxygen sensor and tighten the bolts to **50–60 Nm**.
2. Connect the wire harness connector terminal of the oxygen sensor.
3. Fit the battery earth lead.

Manifold Absolute Pressure Temperature Sensor

Removal

1. Disconnect the battery earth lead.
2. Disconnect the wire harness connector terminal of the manifold absolute pressure temperature sensor.
3. Remove the bolts securing the manifold absolute pressure temperature sensor to the intake manifold, and remove the sensor.



S113B408

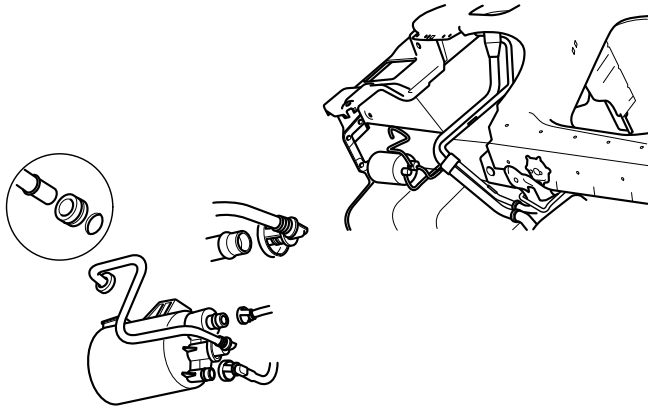
Refit

1. Clean the mating surface of the manifold absolute pressure temperature sensor and intake manifold.
2. Fit the manifold absolute pressure temperature sensor and tighten the bolts to **4–5 Nm**.
3. Connect the wire harness connector terminal of the manifold absolute pressure temperature sensor.

Canister

Removal

1. Raise the vehicle on a lift.



2. Remove the bolts securing the canister to the body and remove the canister.
3. Disconnect the breather hose.
4. Disconnect the canister solenoid valve hose and the fuel tank hose from the canister.
5. Remove the canister.

Caution: Plug the disconnected unions to prevent contamination entering.

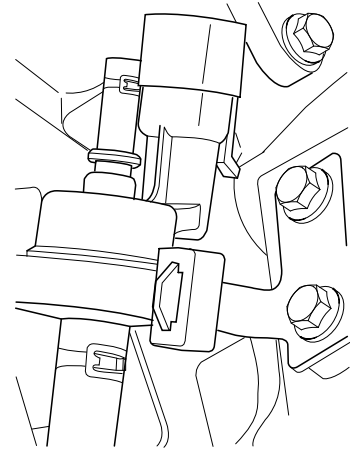
Refit

1. Make sure all the hose connections are clean.
2. Connect the fuel tank hose, canister solenoid valve hose and the breather hose to the canister.
3. Secure the canister to the body and tighten the bolts to **16-18 Nm**.
4. Lower the vehicle.

Canister Solenoid Valve

Removal

1. Disconnect the battery earth lead.
2. Disconnect the canister solenoid valve connector.
3. Disconnect the vacuum hose from the canister solenoid valve.
4. Disconnect the fuel breather hose from the canister solenoid valve.
5. Remove the canister solenoid valve from the canister solenoid valve bracket for engine block.



Refit

1. Connect the fuel breather hose to the canister solenoid valve.
2. Connect the vacuum hose to the canister solenoid valve.
3. Connect the canister solenoid valve connector.
4. Secure the canister solenoid valve to the canister solenoid valve bracket for the engine block.

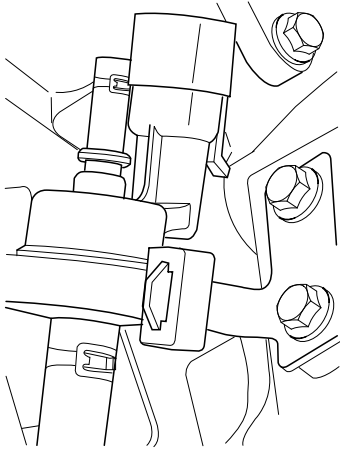
Floor Lower Fuel Pipe

Removal

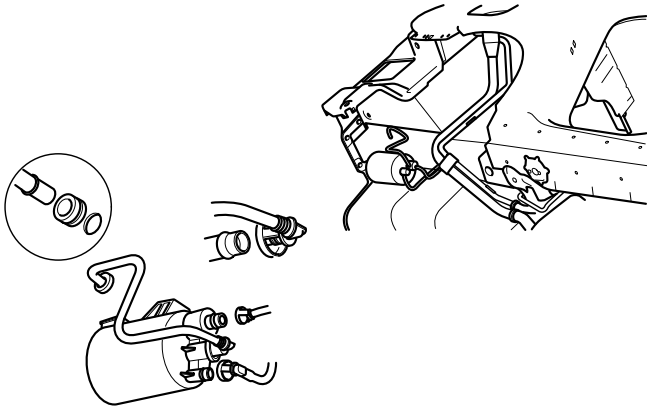
1. Drain the fuel system.

Fuel Tank – Drain

2. Disconnect the canister breather hose from the canister solenoid valve.



3. Disconnect the fuel inlet hose from the fuel rail.
4. Raise the vehicle on a lift.
5. Disconnect the fuel pipe from the fuel filter.
6. Disconnect the fuel pipe from the fuel tank.
7. Loosen the 18 snap fits securing the floor lower fuel pipe assembly to the underbody.
8. Disconnect the floor lower fuel pipe from the canister.



9. Remove the floor lower fuel pipe.

Refit

1. Hold the floor lower fuel pipe to the 18 snap fits of the underbody.
2. Connect the connecting line between the fuel pipe and the canister.
3. Connect the connecting line between the fuel pipe and the fuel tank.

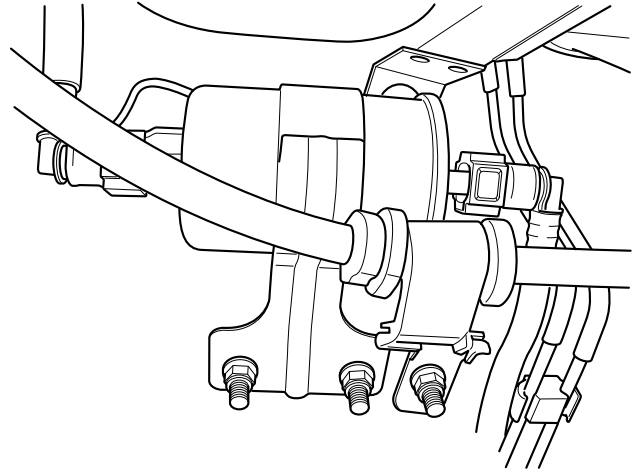
Fuel Filter

Removal

1. Connect the fuel pipe and the fuel tank.
2. Discharge the fuel system pressure.

Fuel System – Discharge Pressure

3. Raise the vehicle on a lift.
4. Disconnect the fuel pipe joint from the fuel filter.



Caution: Plug the disconnected unions to prevent contamination entering.

Warning: Discharge the system pressure before disconnecting any components. Even if the ignition switch has turned off, the system pressure will be maintained for a certain period of time.

5. Remove the 2 nuts securing the fuel filter to the bracket and remove the fuel filter.

Refit

1. Position the earth lead terminal.
2. Position the fuel filter to the filter bracket and tighten the nuts securing the fuel filter to the bracket to **6-7 Nm**.
3. Remove the plug and connect the fuel pipe joint to the fuel filter.
4. Lower the vehicle.
5. Connect the battery earth lead.

Fuel Tank

Removal

1. Disconnect the battery earth lead.

Warning: Fuel vapour is highly flammable, and it is also explosive and toxic in a confined space. There must have a fire extinguisher, such as foam, CO₂, gas or powder extinguisher when working on the fuel system or draining the fuel.

2. Discharge the fuel system pressure.

Fuel System - Discharge Pressure

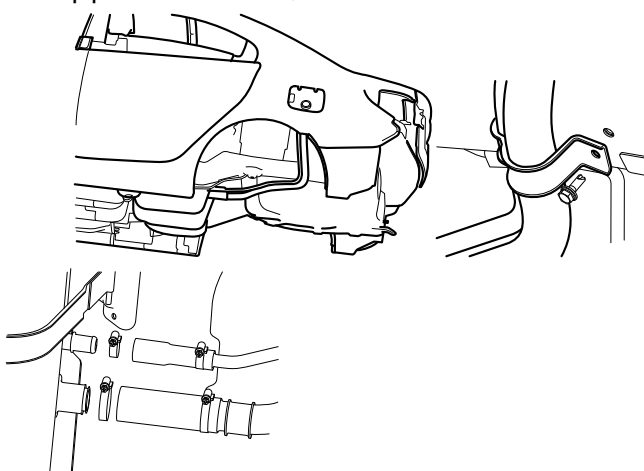
Warning: Fuel vapour is highly flammable, and it is also explosive and toxic in a confined space. There must have a fire extinguisher, such as foam, CO₂, gas or powder extinguisher when working on the fuel system or draining the fuel.

3. Loosen the sealed panel of the hand brake lever.
4. Loosen the adjustment nut of the hand brake cable.
5. Drain the fuel system.

Fuel Tank - Drain

Caution: Before disconnecting any components of the fuel system, it is imperative that any dust, dirt and debris around the components are removed to prevent the foreign matter from entering the fuel system when operating.

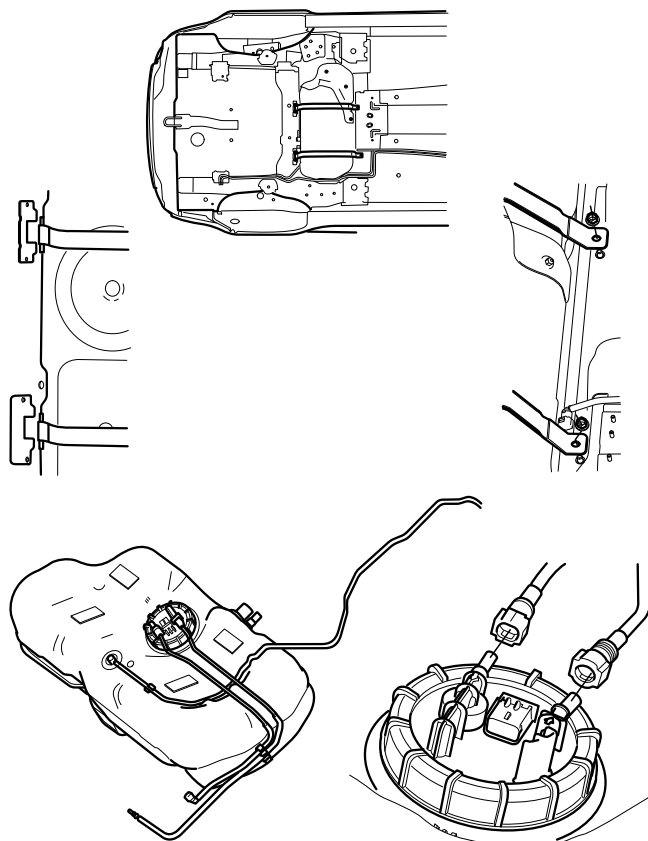
6. Raise the vehicle on a lift.
7. Loosen the breather hose from the canister to the fuel tank.
8. Loosen the clips of the hose from the fuel tank filler pipe to the fuel tank, and remove the hose.



Warning: Fuel leakage is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

9. Support the fuel tank well.
10. Remove 2 bolts securing the fuel tank steel strip to the body, and remove the steel strip. Lower the fuel tank to reach the top of the fuel tank.

11. Disconnect the fuel pump connector.



12. Disconnect the fuel feed pipe and fuel return tube between the fuel pump and the fuel filter from the fuel pump.
13. Remove the fuel tank with others' help.

Refit

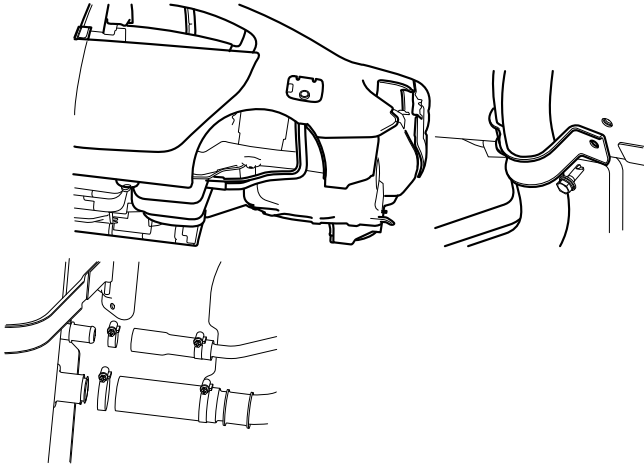
1. Fit a new seal to the fuel tank and fit the fuel pump. Be careful not to damage or lose the seal.
2. Fit the fuel pump locking ring with **T18007** and tighten it to **80-85 Nm**.
3. Support the fuel tank with others' help.
4. Connect the fuel feed pipe and fuel return tube from the fuel filter to the fuel pump.
5. Connect the fuel tank filler tube to the fuel tank hose and tighten it with clips.
6. Connect the fuel pump connector.
7. Raise the fuel tank and align it with the fuel tank holding steel strip.

Caution: Take care not to bend any pipes or cables when fitting the fuel tank.

8. Raise the fuel tank assembly to the underbody of the seat floor with a lifting frame, and engage the pin end of the steel strip in the front into the white body welded mount. And then align the mounting hole of the steel strip in the rear with the body welded screw. Fit it with nuts and tighten them to **21-25 Nm**.
9. Connect the fuel tank breather hose to the canister,

and secure the breather hose to the body.

10. Connect the fuel filler pipe to the fuel tank. Tighten the fuel filler pipe bracket set bolts to **6-7 Nm**, fit the hose from the fuel filler pipe to the fuel tank and secure it with clips. The torque is **3-5 Nm**.



11. Lower the vehicle.
12. Fill the fuel tank.
13. Connect the battery earth lead.

Fuel Pump

Removal

1. Disconnect the battery earth lead.

Warning: Fuel vapour is highly flammable, and it is also explosive and toxic in a confined space. There must have a fire extinguisher, such as foam, CO₂, gas or powder extinguisher when working on the fuel system or draining the fuel.

Warning: Discharge the fuel system pressure before disconnecting any components. Even if the ignition switch has turned off, the system pressure will be maintained for a certain period of time.

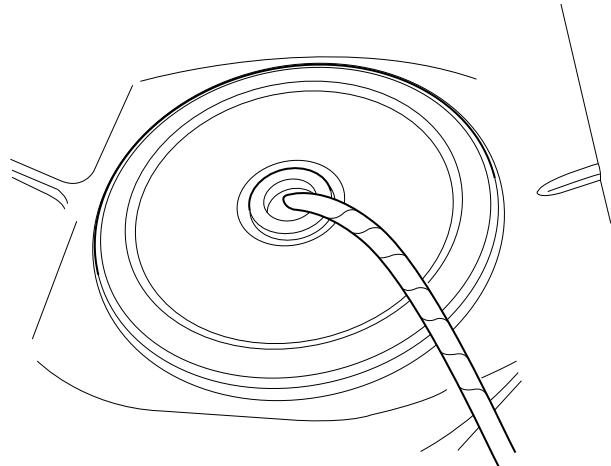
2. Discharge the fuel system pressure.

Fuel System - Discharge Pressure

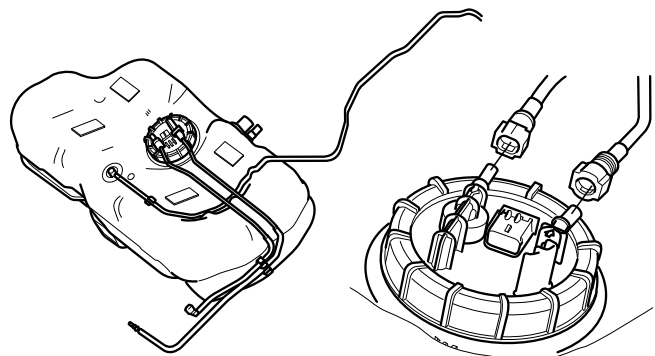
3. Remove the rear seat cushion.

Rear Seat Cushion Assembly

4. Remove the carpet and the sound insulator.



5. Pry out the sealed plate with a screwdriver.
6. Cover the surrounding area to prevent fuel overflowing.



7. Disconnect the connector from the fuel pump.
8. Loosen the fuel feed pipe and the fuel return tube from the fuel pump.

Caution: Before disconnecting any components of the fuel system, it is imperative that any dust, dirt and debris around the components are removed to prevent the foreign matter from entering the fuel system when operating.

Warning: Fuel leakage is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

9. Using the **T18007**, loosen and remove the fuel pump locking ring.
10. Take out the fuel pump unit carefully and dispose of the seal.

Refit

1. Fit a new seal to the fuel tank, fit the fuel pump, be careful not to damage or lose the seal.
2. Fit the fuel pump locking ring with the **T18007** and tighten to **80-85 Nm**.
3. Connect the fuel feed pipe and fuel return tube to the fuel pump union.
4. Connect the fuel pump connector.
5. Affix the sealed plate with the adhesive.
6. Put the sound insulator and the carpet to the original position.
7. Fit the rear seat cushion.

Rear Seat Cushion Assembly

8. Connect the battery earth lead.

Fuel System - Discharge Pressure

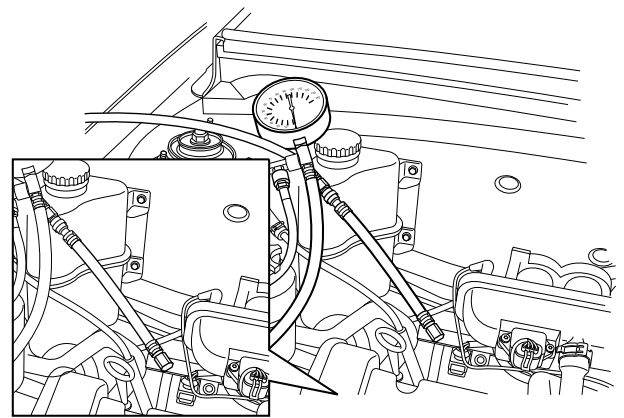
Inspection

1. Place a piece of cloth with excellent absorbency around the fuel rail to collect the fuel that flows out.

Warning: Fuel vapour is highly flammable, and it is also explosive and toxic in a confined space. There must have a fire extinguisher, such as foam, CO₂, gas or powder extinguisher when working on the fuel system or draining the fuel.

Warning: Fuel leakage is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

Remove the dust cover from the fuel rail.



S183038

2. Connect the joint **T18003** to the quick joint on the fuel rail.

Notice: When the **T18003** and the fuel rail quick joints are connected, never tighten them with excessive force, just insure that there is no leakage, or the **T18003** O-ring may be damaged.

3. Place the end of the joint into a proper container.
4. Loosen the DIP switch to discharge the fuel system pressure, collect the fuel.
5. Tighten the DIP switch, and remove the container.
6. Remove the joint **T18003** and fit the dust cover.

Fuel System - Pressure Test

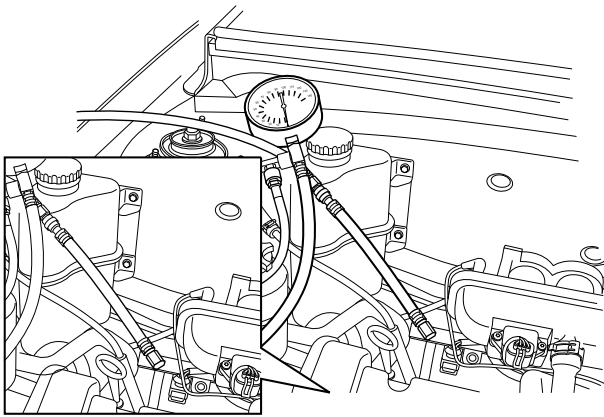
Inspection

1. Place a piece of cloth with excellent absorbency around the fuel rail to collect the fuel that flows out.

Warning: Fuel vapour is highly flammable, and it is also explosive and toxic in a confined space. There must have a fire extinguisher, such as foam, CO₂, gas or powder extinguisher when working on the fuel system or draining the fuel.

Warning: Fuel leakage is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

2. Remove the dust cover from the fuel rail.



S183038

3. Connect the joint **T18003** to the **T18002** compression gauge.
4. Secure the compression gauge **T18002**, connect the **T18003** to the quick joint on the fuel rail.

Important: When the **T18003** and the fuel rail quick joints are connected, never tighten them with excessive force, just insure that there is no leakage, or it may be damaged.

5. Put the oil drain pipe into a proper container.
6. Start the engine and observe the reading and the pressure drop value within one minute, and then stop the engine.
7. Disconnect the **T18003** from the fuel rail quick joint.
8. Loosen the clips, disconnect the **T18003** from the compression gauge **T18002**.
9. Fit the dust cover.
10. Drain the fuel into the container through the gauge.

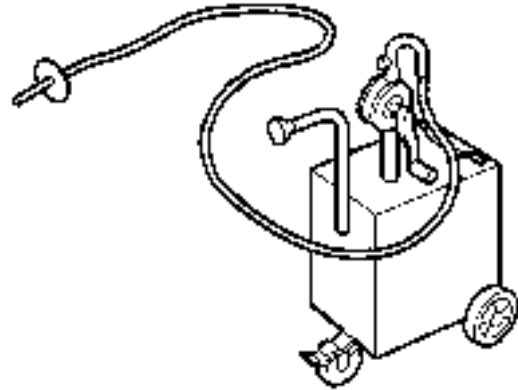
Fuel Tank - Drain

Warning: When it is needed to discharge or drain the fuel during repairing the vehicle, this operation must be carried out in a location with good air ventilation. DO NOT drain the fuel into or store the fuel in an opening container, it must be use the approved container, the capacity of containers should be more than the amount of fuel to be extracted or drained. The content of the container should be clearly marked and the container is placed in a safe storage area, also complies with the requirements of local authority regulation.

1. Remove the fuel pump.

Fuel Pump

2. Using a fuel recovery unit, drain the fuel from the fuel tank into a sealed container. For the connection and safety of the fuel recovery unit, follow the manufacturer's instructions.



S183001

3. Fit the fuel pump to the fuel tank.


Fuel Pump

4. Fill the fuel tank.

Fuel Filler Pipe

Removal

1. Disconnect the battery earth lead.
2. Discharge the fuel system pressure.

 **Fuel System – Discharge Pressure**

Warning: Fuel vapour is highly flammable, and it is also explosive and toxic in a confined space. There must have a fire extinguisher, such as foam, CO2, gas or powder extinguisher when working on the fuel system or draining the fuel.

Warning: Fuel leakage is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.

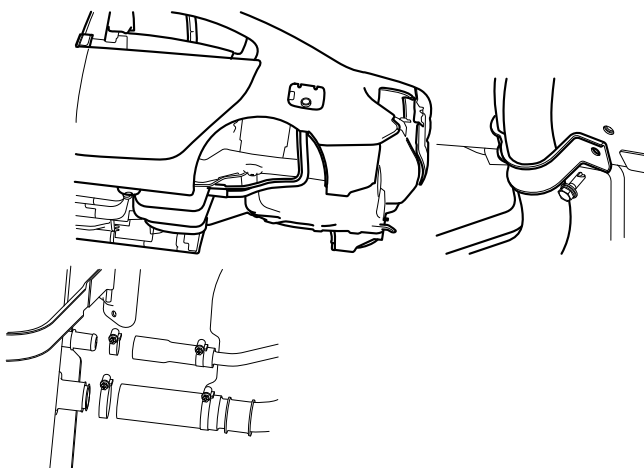
Caution: Before disconnecting any components of the fuel system, it is imperative that any dust, dirt and debris around the components are removed to prevent the foreign matter from entering the fuel system when operating.

Caution: Plug the disconnected unions to prevent contamination entering.

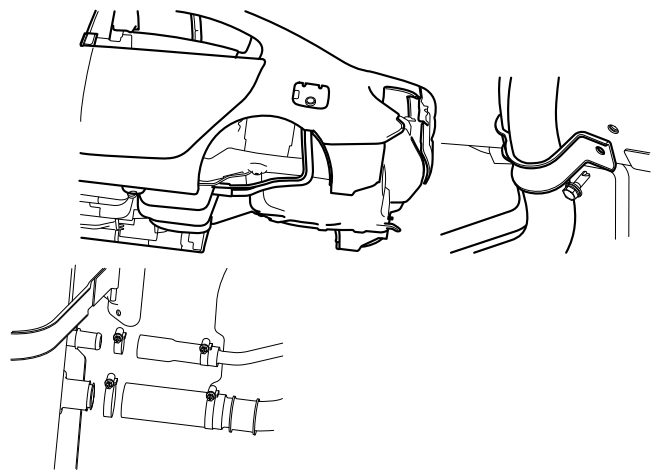
3. Drain the fuel tank.

 **Fuel Tank – Drain**

4. Remove the filler cap from the filler.
5. Remove the rear wheel house LH.
6. Remove the bolts securing the filler of the filler pipe to the body from the underside of the wheel house.



7. Remove the bolts securing the filler pipe to the body.
8. Loosen the clips of the hose from the fuel tank filler pipe to the fuel tank, and remove the hose.



9. Remove the fuel filler pipe.

Refit

1. Position the filler pipe, and connect the filler pipe to the hose from the filler pipe to the fuel tank and secure it with clips.
2. Secure the filler of the filler pipe to the body from the underside of the wheel house, and tighten the bolts to **6-7 Nm**.
3. Secure the filler pipe to the body and tighten the bolts to **6-7 Nm**.
4. Fit the head of the fuel filler pipe assembly into the oiling groove hole.
5. Fit the rear wheel house RH.

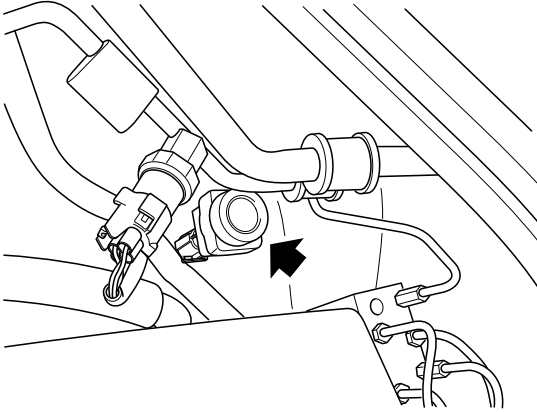
 **Rear Wheel House**

6. Fill the fuel tank.
7. Fit the filler cap.
8. Connect the battery earth lead.

Fuel Pump Inertia Switch

Removal

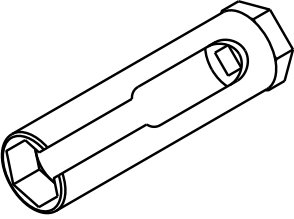
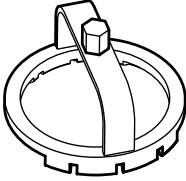
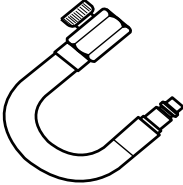
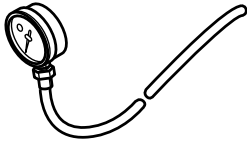
1. Open the bonnet.
2. Disconnect the battery earth lead.
3. Remove the 2 nuts securing the inertia switch to the body, release the switch and get close to the connector.
4. Disconnect the connector from the inertia switch and remove the switch.



Refit

1. Connect the connector to the inertia switch.
2. Position the inertia switch to the studs to be welded on the body, fit the set nuts and tighten to **1.6-2.4 Nm**.
3. Press the top of switch to make sure the setting is completed.
4. Connect the battery earth lead.
5. Cover the bonnet.

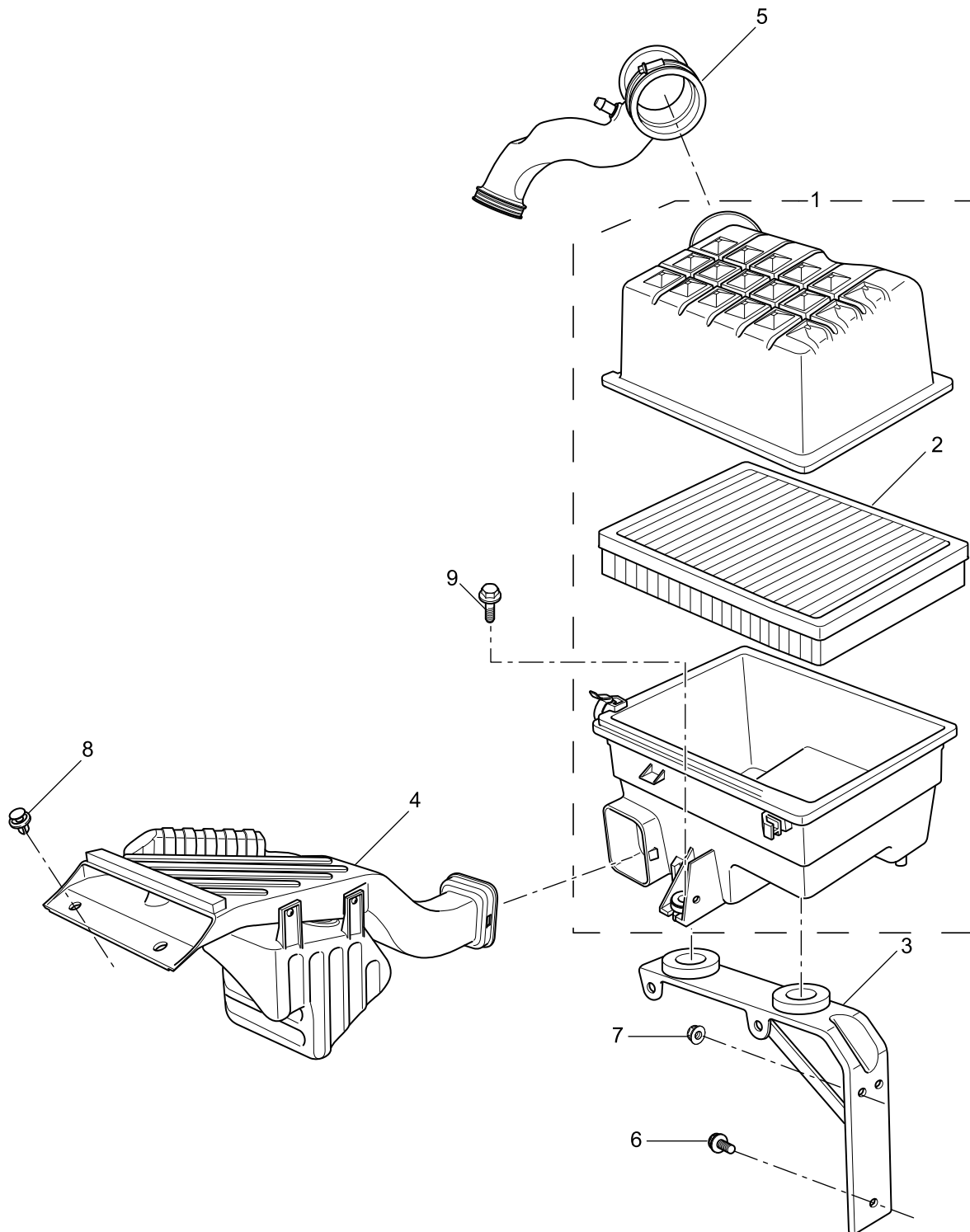
Special Tools

| Tool Number | Description | Picture |
|-------------|-------------------------------|---|
| TEN00011 | Oxygen Sensor Replacer |  <p>TEN00011</p> |
| T18007 | Fuel Tank Locking Ring Wrench |  <p>T18007</p> |
| T18003 | Fuel Pressure Quick Joint |  <p>T18003</p> |
| T18002 | Fuel Pressure Gauge |  <p>T18002</p> |

Engine Manifold & Exhaust System**Specifications****Torque**

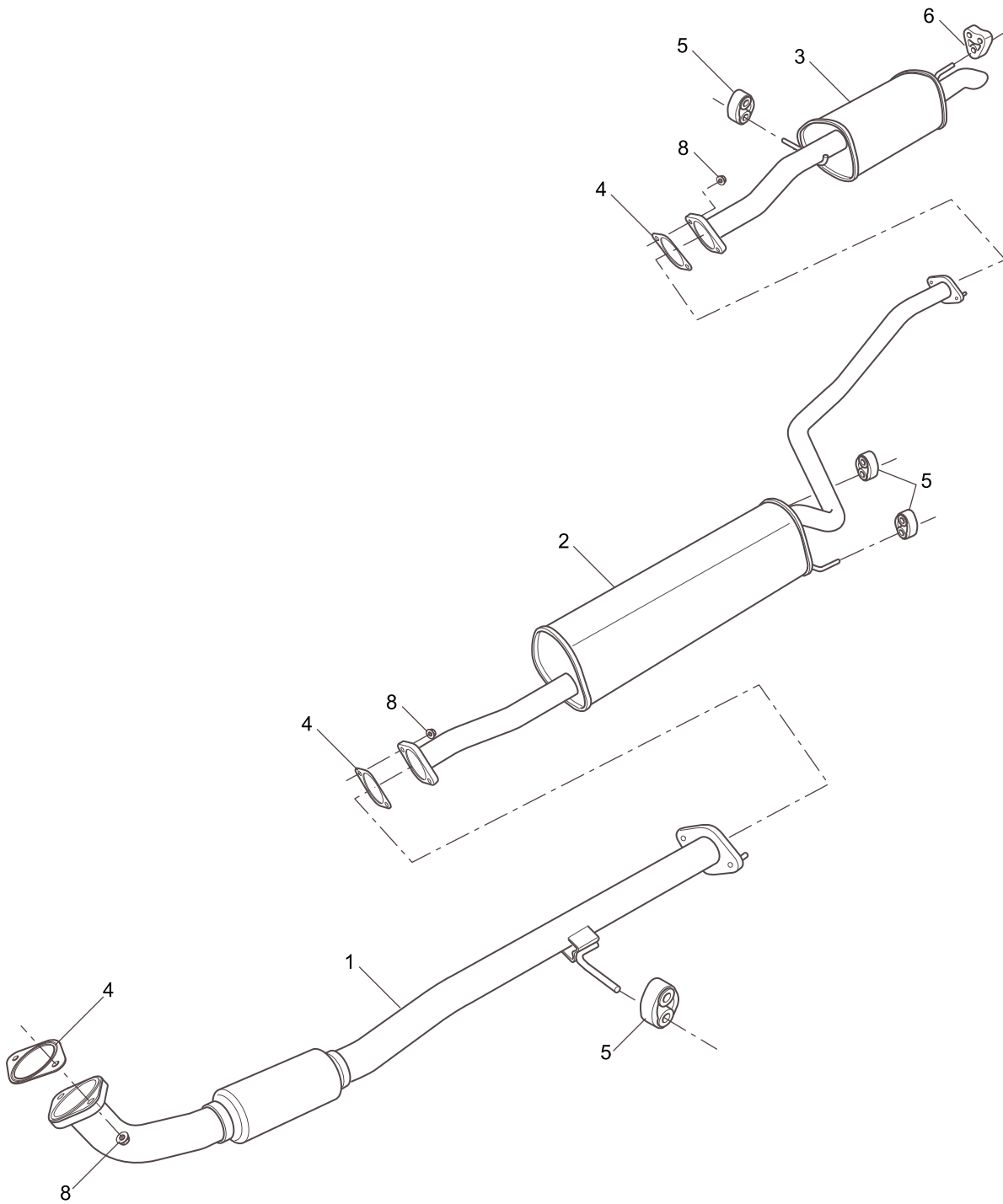
| Description | Value |
|--|------------|
| Bolt - Securing Air Cleaner to Battery Support | 15-20 Nm |
| Clamp - Securing Air Cleaner Outlet Duct | 2.5-3.5 Nm |
| Nut - Securing Exhaust Manifold and Front Exhaust Pipe | 19-25 Nm |
| Nut - Securing Front Exhaust Pipe and Centre Silencer Assembly | 45-55 Nm |
| Nut - Securing Exhaust Centre Silencer Assembly and Rear Silencer Assembly | 45-55 Nm |
| Nut - Securing Exhaust Passage Rear Heat Shield | 4-5 Nm |
| Bolt/Nut - Securing Exhaust Passage Centre Heat Shield | 4-5 Nm |

Description and Operation
 System Component Layout
 Intake System Component Layout



- | | |
|---------------------------------|---|
| 1. Air Cleaner Assembly | 5. Air Cleaner to Throttle Body Outlet Pipe |
| 2. Cleaner Element | 6. Bolt - Air Cleaner Bracket to Body |
| 3. Air Cleaner Bracket Assembly | 7. Nut - Air Cleaner Bracket to Body |
| 4. Air Cleaner Intake Pipe | 8. Cotter Pin - Air Cleaner Intake Pipe |

Exhaust System Component Layout



- | | |
|--------------------------------|-------------------------------------|
| 1. Front Exhaust Pipe Assembly | 5. Exhaust System Front Lifting Lug |
| 2. Centre Silencer Assembly | 6. Exhaust System Rear Lifting Lug |
| 3. Rear Silencer Assembly | 7. Nut - Front Exhaust System |
| 4. Shim - Exhaust System | |

Description

Air Cleaner

The air outlet pipe is fitted between the air cleaner and the throttle body, and secured with worm gear drive clamps. The air cleaner assembly is secured to the body through the connection of the air cleaner bracket assembly.

Exhaust System

The exhaust system consists of two disc stainless steels, combined with two silencers. The adjacent pipes are secured

with nuts and the stud bolts with mounting washers. There are five rubber lifting lugs. And the first two are silicone resin rubber, which secure the exhaust system to the body, allowing the exhaust device to move slightly to prevent the body from vibrating. The fitted heat shield prevents the body from being at a too high temperature. And the tailpipe adopts the single-hole stainless steel integration design.

Operation

Air Cleaner

Air enters the intake hose above the radiator in the front engine bay, and passes through the air cleaner element in which the impurities in the air are captured.

The air from the air cleaner passes through the outlet pipe, and is transmitted to the throttle valve through the outlet pipe.

Exhaust Manifold and Exhaust System

The exhausted hot air passes through every outlet, enters the exhaust manifold whose branches collect the air into a flange, passes through the three-way catalytic converter into the exhaust system and then enters the silencer. The front silencer is absorptive, through which a perforated pipe passes, and it can also minimize the restriction of the air flow. The rear silencer is a reflective silencer, which emits the sound wave with the interior obstacles, to decrease the noise level.

Three-Way Catalytic Converter (TWC)

Warning: *Three-way catalytic converter operates in extremely high temperature, so take extra care when handling these components.*

Caution: *In order to operate the three-way catalytic converter effectively and prevent premature damage, it is prohibited that the leaded fuel is used and the unburned fuel enters the exhaust system.*

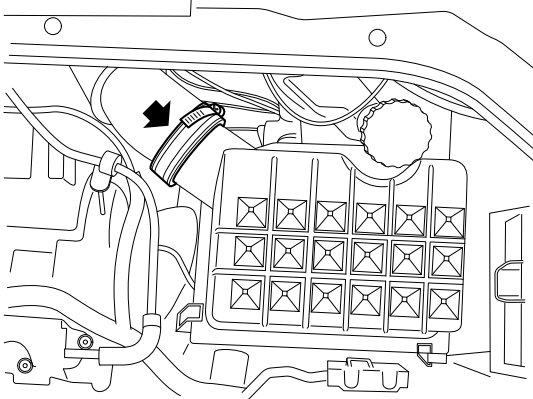
The main combustion occurs in the combustion chamber, and the exhausted gas passes through the exhaust manifold into **TWC**. **TWC** can only work efficiently when it reaches the minimum operating temperature. The exhausted gas enters the integrated structure coated with platinum and rhodium (catalyst), where two steps occur - disoxidation and oxidation. Nitric oxide (**NOx**) is deoxidized into nitrogen, and oxygen is combined with carbon monoxide (**CO**) and formed into carbon dioxide. Hydrocarbon (**HC**) and **CO** will continue to react in the three-way catalytic converter with the oxygen remaining in the air. Thus hydrogen and carbon are oxidized into water and **CO₂**.

Service Procedures

Air Cleaner Assembly

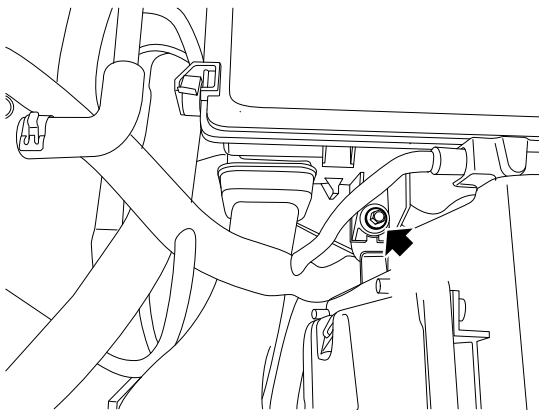
Removal

1. Loosen the clamp securing the outlet pipe and the air cleaner assembly;



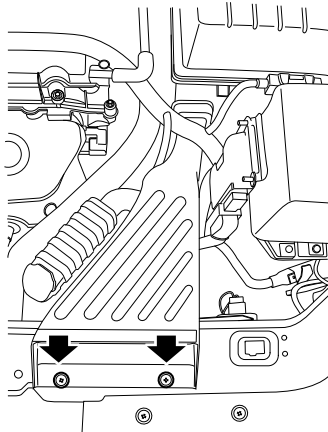
S911A401

2. Remove the nut securing the air cleaner to the battery support;



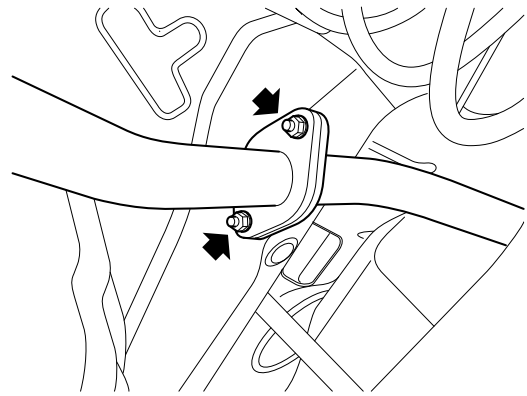
S911A402

3. Remove the two cotter pins securing the intake pipe to the modular front end panel;



S911A403

4. Disconnect the connection between the intake pipe and the air cleaner, and remove the intake pipe;

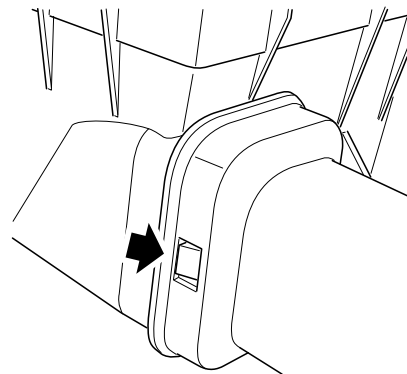


S931A404

5. Loosen the air cleaner from the two grommets and remove the air cleaner assembly.

Refit

1. Fit the air cleaner and secure it to the grommet;
2. Tighten the nut securing the air cleaner to the battery support, and tighten the torque to **15-20 Nm**;
3. Connect the outlet pipe to the air cleaner, tighten it with the clamp, and tighten the torque to **2.5-3.5 Nm**;
4. Align the stopper on the back of the air cleaner intake pipe with the hole on the back (the connection) of the air cleaner intake pipe, align the mark, push in and lock up.



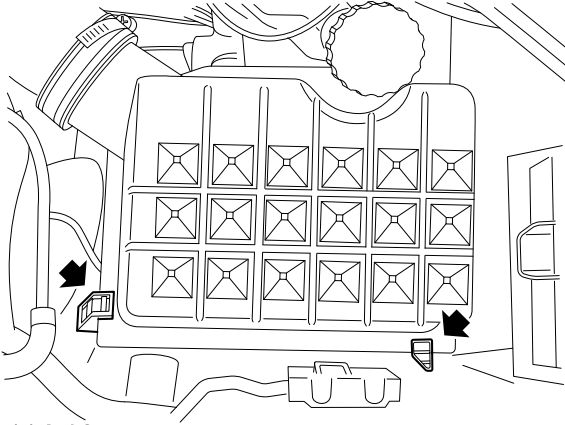
S911A408

5. Place the air cleaner intake pipe to the mounting position, align the mounting hole and tighten the cotter pin - air cleaner intake pipe.

Air Cleaner Element

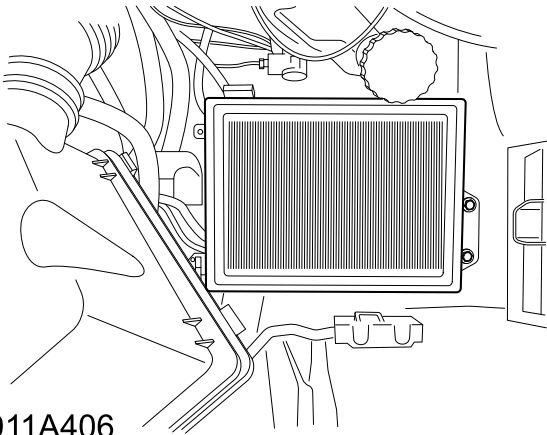
Removal

1. Loosen the clamp securing the outlet pipe and the air cleaner assembly.
2. Loosen the clip securing the air cleaner cap;



S911A405

3. Loosen and open the cap to make it possible to contact the air cleaner element;



S911A406

4. Remove the air cleaner element.

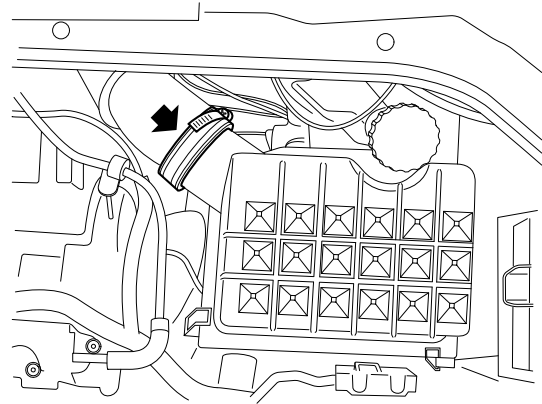
Refit

1. Clean the inside of the air cleaner;
2. Fit the air cleaner element;
3. Fit the air cleaner cap and attach the clip;
4. Connect the outlet pipe to the air cleaner, tighten it with the clamp, and tighten the torque to **2.5-3.5 Nm**.

Intake Pipe Assembly

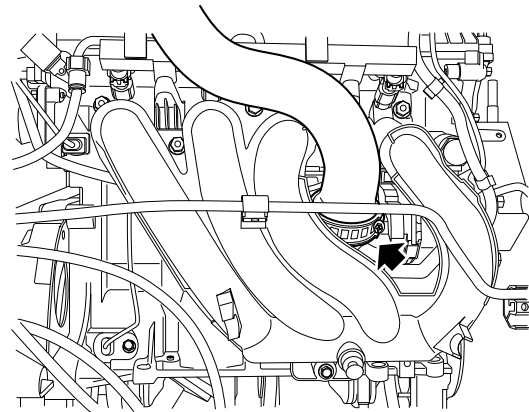
Removal

1. Loosen the clamp securing the intake pipe and the air cleaner assembly;



S911A401

2. Loosen the clamp at the intake pipe and the throttle valve.



S911A407

3. Take out the intake pipe.

Refit

1. Insert the two ends of the intake pipe onto the throttle valve and the air cleaner.
2. Tighten the clamp on the throttle valve.
3. Tighten the clamp on the air cleaner.

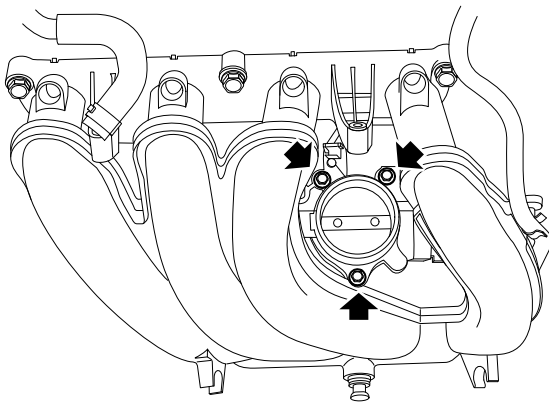
Electronic Throttle Valve

Removal

1. Disconnect the battery negative terminal.
2. Disconnect the connection of the electronic throttle valve wire connector.
3. Take out the intake manifold and the electronic throttle valve.

 **Intake Manifold Gasket**

4. Remove the three bolts connecting the electronic throttle valve and the intake manifold, and remove the electronic throttle valve.



S111Q402

Refit

Tip: In order to protect against being frozen, replace the electronic throttle valve when the ambient temperature is higher than 6 °C.

1. Fit the new electronic throttle valve washer into the intake manifold groove (make sure that the seal surface is clean).
2. Clean the mating surface of the electronic throttle valve and the intake manifold, secure the three bolts connecting the electronic throttle valve and the intake manifold, and fit the electronic throttle valve.
3. Fit the intake manifold and the intake manifold gasket.

 **Intake Manifold Gasket**

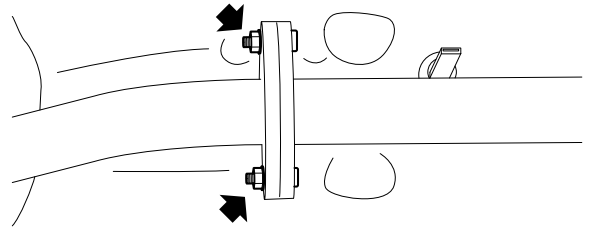
4. Connect the electronic throttle valve wire connector.
5. Connect the battery ground terminal.

Front Exhaust Pipe Assembly

Removal

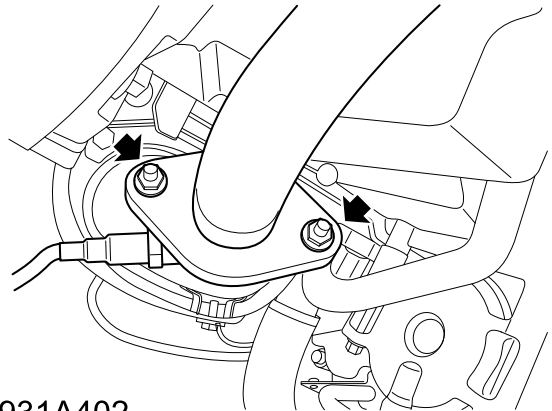
Warning: Exhaust components may be extremely hot, in order to avoid the danger of being burnt, etc., handling must be performed after the system has sufficiently cooled down.

1. Raise the vehicle on a lift.
2. Remove the 2 nuts securing the front exhaust pipe to the exhaust centre silencer.



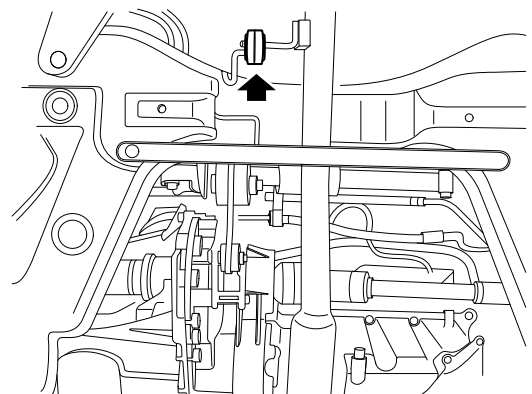
S931A401

3. Remove the 2 nuts securing the front exhaust pipe to the exhaust manifold.



S931A402

4. Remove the 1 rubber lifting lug secured on the body.



S931A403

5. Loosen and remove the front exhaust pipe from the

manifold.

6. Remove the gaskets from the exhaust manifold and the centre silencer assembly flange, and dispose of them.

Refit

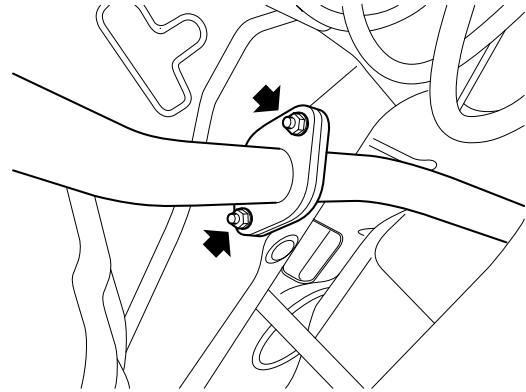
1. Clean the front exhaust pipe flange face.
2. Fit a new gasket to the flange connection of the front exhaust pipe and the centre silencer assembly.
3. Align the hole of the front exhaust pipe flange face with the bolt of the centre silencer assembly flange face, fit the nut but **DO NOT** tighten it in this step.
4. Fit a new gasket to the manifold flange face.
5. Align the hole of the front exhaust pipe flange face with the bolt of the exhaust manifold flange face.
6. Fit and tighten the nut of flange face in the torque of **19-25 Nm**.
7. Tighten the nuts connecting the front exhaust pipe and the centre silencer assembly in the torque of **45-55 Nm**.
8. Connect the front pipe and the underbody hook with a rubber lifting lug.
9. Remove the support and lower the vehicle.

Centre Silencer Assembly

Removal

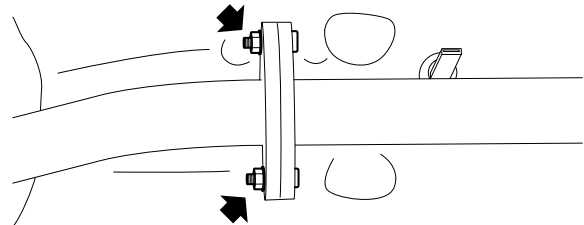
Warning: Exhaust components may be extremely hot, in order to avoid the danger of being burnt, etc., handling must be performed after the system has sufficiently cooled down.

1. Raise the vehicle on a lift;
2. Remove the 2 nuts securing the exhaust centre silencer to the exhaust rear silencer;



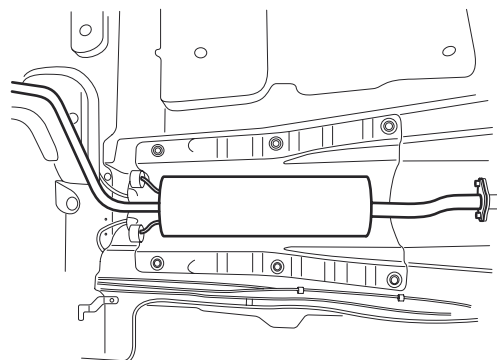
S931A404

3. Remove the 2 nuts securing the exhaust centre silencer to the front exhaust pipe;



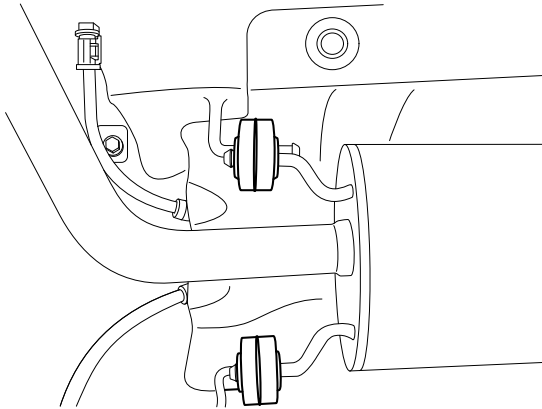
S931A401

4. Remove the exhaust centre silencer from the front exhaust pipe;



S931A405

- Remove the 2 rubber lifting lugs securing the exhaust centre silencer to the body.



S931A406

- Loosen and remove the exhaust centre pipe, and remove the gaskets from the front flange face and the rear flange face of the exhaust centre pipe.

Refit

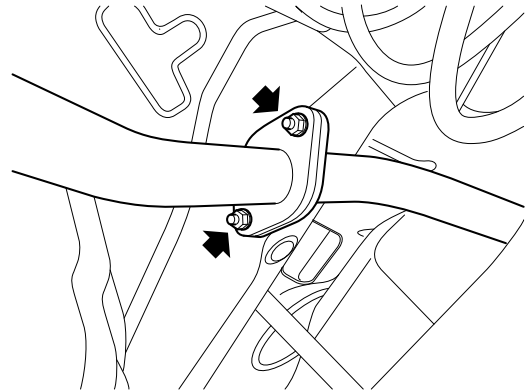
- Remove the gaskets from the front flange face and the rear flange face of the centre silencer assembly.
- Fit the new gaskets at the flange face connection of the centre silencer assembly and the front exhaust pipe assembly and the flange face connection of the centre silencer assembly and the rear silencer assembly.
- Fit the centre silencer assembly to the rear silencer assembly, align and connect it to the front exhaust pipe assembly.
- Connect the centre silencer assembly and the underbody hook with the rubber lifting lug.
- Fit and tighten the nuts connecting the centre silencer assembly and the front exhaust pipe assembly in the torque of **45-55 Nm**
- Lower the vehicle.

Rear Silencer Assembly

Removal

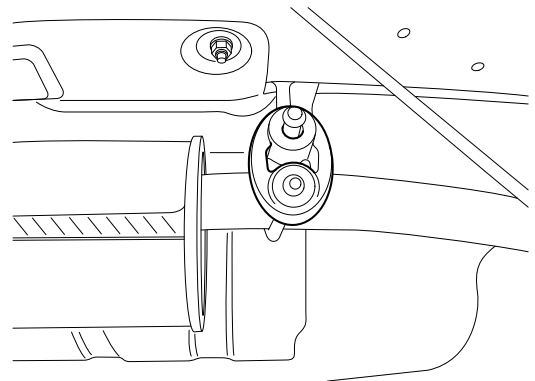
Warning: Exhaust components may be extremely hot, in order to avoid the danger of being burnt, etc., handling must be performed after the system has sufficiently cooled down.

- Raise the vehicle on a lift;
- Remove the 2 nuts securing the centre silencer assembly to the rear silencer assembly.

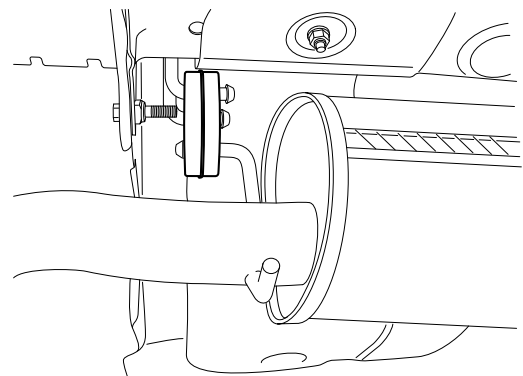


S931A404

- Remove the 2 rubber lifting lugs securing the rear silencer assembly to the body.

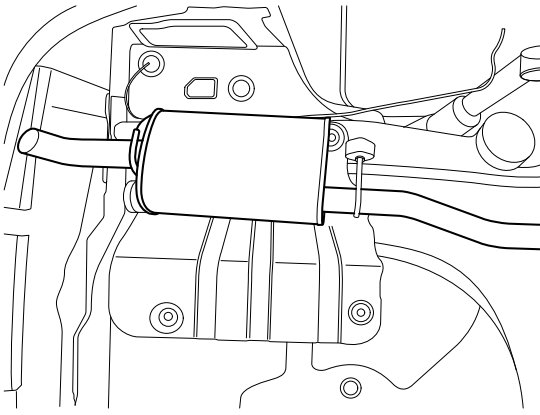


S931A407



S931A408

- Remove the rear silencer assembly.



S931A409

5. Remove and dispose of the gasket.

Refit

1. Clean the flange face between the centre silencer assembly and the rear silencer assembly.
2. Fit the new gasket to the flange face of the centre silencer assembly.
3. Fit the nuts to the flange and tighten them to **45-55 Nm**.
4. Fit the tailpipe and connect it to the body hook with the rubber lifting lug.
5. Lower the vehicle.

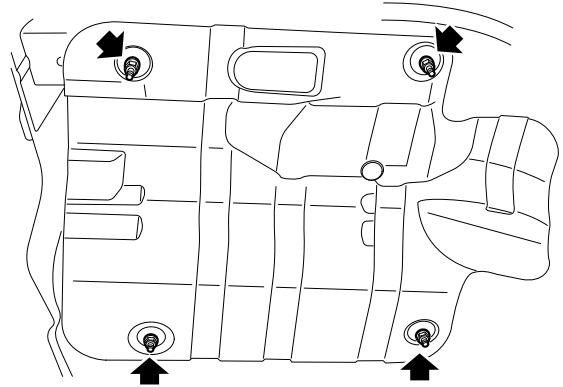
Heat Shield - Rear Silencer Assembly

Removal

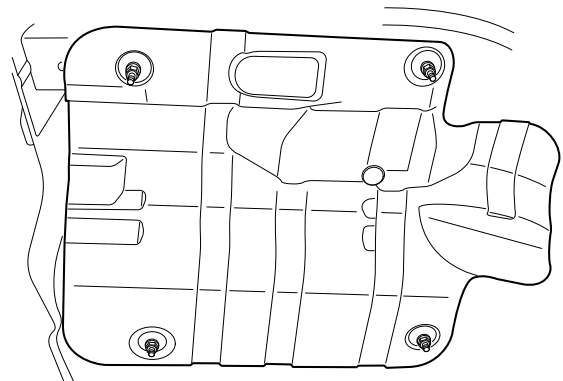
1. Remove the rear silencer assembly.

Rear Silencer Assembly

2. Remove the four nuts securing the heat shield, and remove the heat shield.



S931B401



S931B402

Refit

1. Fit the heat shield and tighten the set nuts to the torque of **4-5 Nm**;
2. Fit the rear silencer assembly.

Rear Silencer Assembly

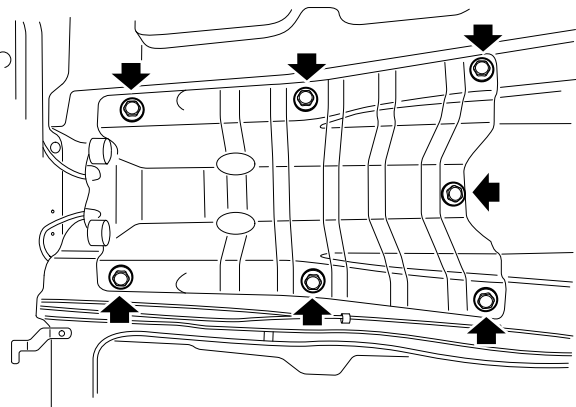
Heat Shield - Centre Silencer Assembly

Removal

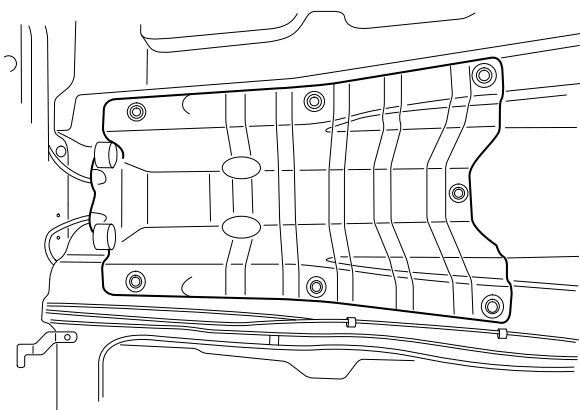
1. Remove the centre silencer assembly.

Centre Silencer Assembly

2. Remove the 6 bolts and one nut securing the heat shield, and remove the heat shield.



S931B403



S931B404

Refit

1. Fit the heat shield and tighten the set nuts and set bolts to the torque of **4-5 Nm**;
2. Fit the centre silencer assembly.

Centre Silencer Assembly

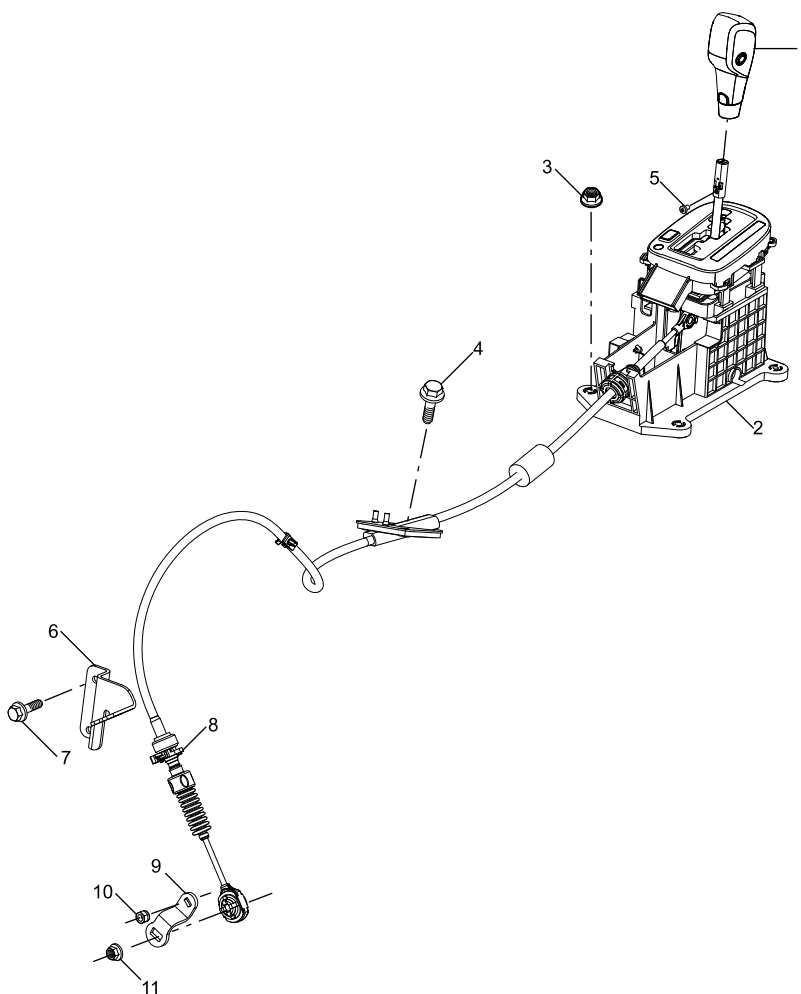
Shift Lock Control-AT**Specifications****Torque**

| Description | Value |
|--|----------|
| Nut - Automatic Shift Mechanism to Body | 19-25 Nm |
| Bolt - Shift Cable to Body | 19-25 Nm |
| Nut - Shift Rocker Arm to Cable | 15-23 Nm |
| Screw - Gear Position Display Circuit Board to Panel | 0.5-1 Nm |
| Screw - Mode Switch Position to Panel | 0.5-1 Nm |

Description and Operation

Description and Operation

System Component Layout



- | | |
|--|---|
| 1. Automatic Transmission Shift Handle | 7. Bolt - Shift Cable Support to Automatic Transmission |
| 2. Automatic Transmission Shift Operating Unit and Cable | 8. Snap Fit - Shift Cable |
| 3. Nut - Shift Mechanism to Centre Path | 9. Automatic Transmission Lever Assembly |
| 4. Bolt - Shift Cable to Body | 10. Nut - Automatic Transmission Case Lever |
| 5. Screw - Automatic Transmission Shift Handle Refit | 11. Nut - Automatic Transmission Case Lever to Cable |
| 6. Jump-shifter Cable Bracket Assembly | |

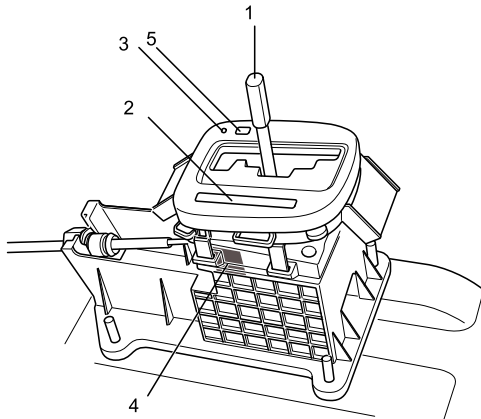
Description

Shift Lever Assembly

Shift lever assembly consists of a lever, base, shift lock solenoid valve, shift cable, shift indicator and mode switch. Shift lever base is fixed to the body centre path with 4 nuts.

Operate the shift lever position as follows:

- P: lock the transmission to prevent the vehicle from sliding.
- R: perform selection only when the vehicle is stationary and the engine is idling.
- N: no turning torque is transmitted to wheels.
- D: all of the 4 forward gears can be used in this position. This is the default selected position in normal driving.
- 2: the position is shifted automatically after being limited at lower 2nd and below.
- L: The position is limited at 1st.



1. Shift Lever
2. Shift Indicator
3. Shift Lever Emergency Unlock Hole
4. Shift Lock Solenoid Valve
5. Mode Switch

Limit Overdrive Gear Switch (OD Off)

Limit overdrive gear switch (OD off) is located on the shift knob, when press the switch after selecting D gear, the automatic transmission is shifted automatically after being limited at 3rd or below. To return to normal mode, press the switch again.

Shift Lock Solenoid Valve

Transmission is equipped with a shift lock solenoid valve at the bottom of the shift lever. The operation of the solenoid valve is determined by the shift lock relay controlled by **BCM** in the passenger compartment fuse block.

When the shift lever is in "P" position, the ignition switch is ON and the brake pedal is not pressed, the interlock solenoid valve is activated, the fixed spring type lock tab is against the

shift lever to prevent it from being moved accidentally. When pressing the brake pedal, the lock-up solenoid does not work, the spring type lock tab can move freely, and the shift lever can be changed to other positions from "P".

Emergency Shift from P Position

The shift lever cannot be disengaged from P with the ignition switch ON and the brake pedal pressed. At this time, turn off the ignition switch, remove the key and press the brake pedal and hold it, pry up the dust cover of the shift unlock hole, insert the ignition key into the shift unlock hole to press the unlock lever, then switch to neutral position, and remove the ignition key from the interlock hole, start the engine and switch to a desired gear.

Shift Cable

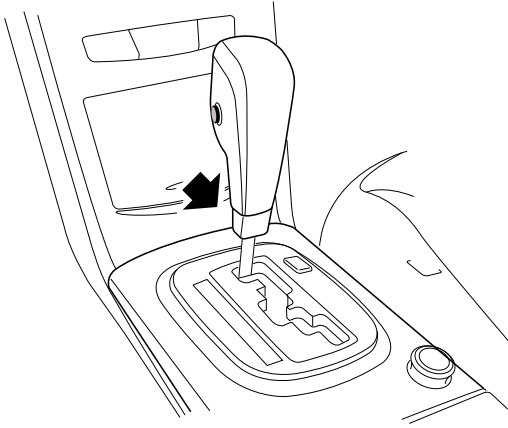
The shift cable connects the shift lever with the shift rocker arm on the transmission. A "C" type clamp fixes the outside cable to the shift lever assembly; the inner cable on the end of shift lever assembly connects the shift lever, and the cable on the end of the transmission is secured to the shift rocker arm of the transmission with a nut.

Service Procedures

Shift Lever Knob - Automatic

Removal

1. Switch the shift lever to neutral.
2. Carefully release the trim cover on the front end of the shift lever knob.



3. Loosen the screw securing the knob to the shift lever.
4. Pay attention to the shift lever knob mounting position, and remove the shift lever knob.

Refit

1. Insert the shift lever knob into the shift lever.
2. Fit and tighten the screw securing the knob to the shift lever.
3. Fit the trim cover on the front end of the shift lever knob.

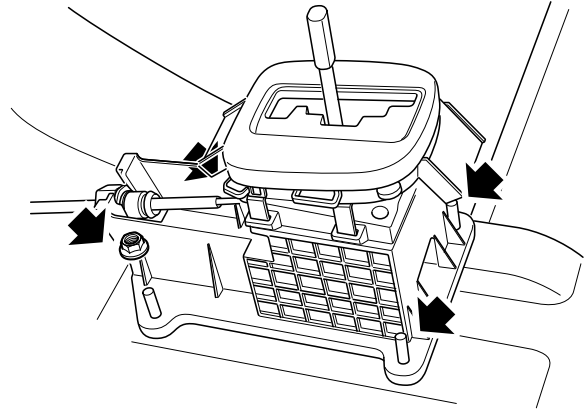
Shift Lever Assembly - Automatic

Removal

1. Remove the centre console assembly.

Centre Console Assembly Removal

2. Release the snap fit securing the hand brake switch wire harness to the shift lever assembly.
3. Remove 4 nuts securing the shift lever assembly to the centre path.



4. Loosen the nut securing the cable to the shift rocker arm.
5. Release the cable from the jump-shift cable bracket assembly.
6. Loosen the 2 bolts securing the cable to the body.
7. Remove the shift lever assembly.

Refit

1. Position the shift lever housing to the body, fit the nut and tighten to **19-25 Nm**.
2. Fix the hand brake switch wire harness to the shift mechanism.
3. Fit 2 bolts securing the cable to the body, and tighten to **19-25 Nm**.
4. Fit the nut securing the cable to the shift rocker arm, and tighten to **15-23 Nm**.
5. Fix the cable to the jump-shift cable bracket assembly.
6. Adjust the cable position and check whether shifting is normal.
7. Fit the centre console assembly.

Centre Console Assembly Refit

Shift Lever Dust Excluder/Sliding Blade

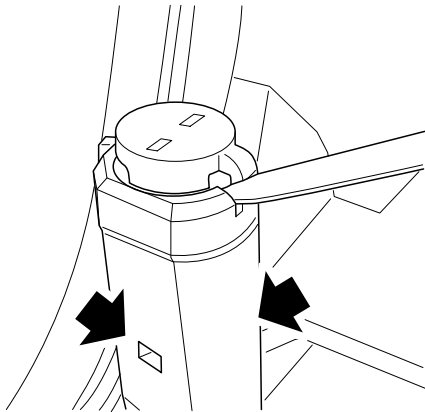
Removal

1. Remove the shift lever knob.

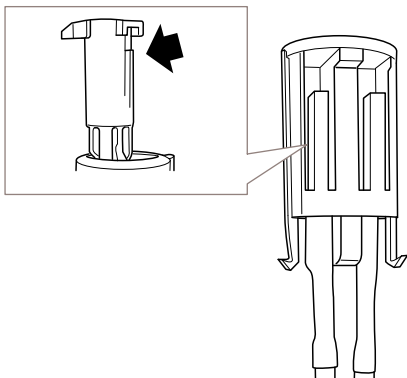
Automatic Shift Lever Knob Removal

2. Insert the T84001 through the front and rear holes of the connection gaiter, and pry up the wire holder at the gap.

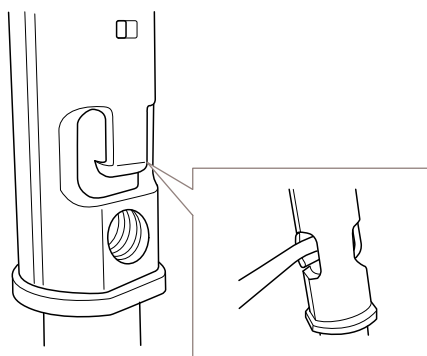
Caution: *DO NOT pull the wire holder forcefully to prevent the O/D wire pin from loosening.*



3. Separate the 2 wire pins from the wire holder, mark them with a marker, pull out the holder slightly.

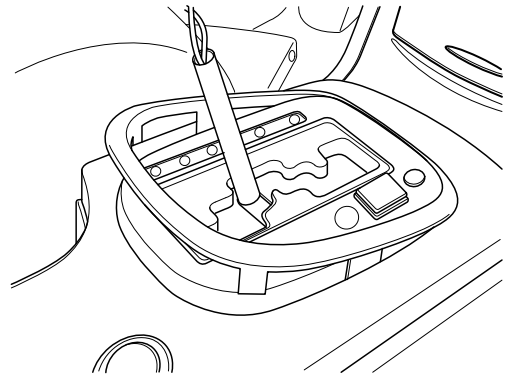


4. Pry out the 2 hold claws of the connection gaiter and pull out the connection gaiter.

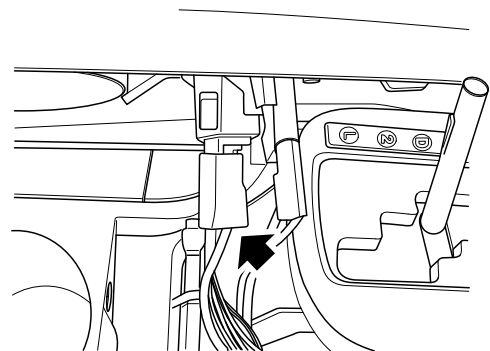


5. Using T52001, uniformly pry out the panel trim ring and the centre console trim panel.

Caution: *Be careful when removing the trim panel, and prevent the trim panel from damage caused by scratching.*

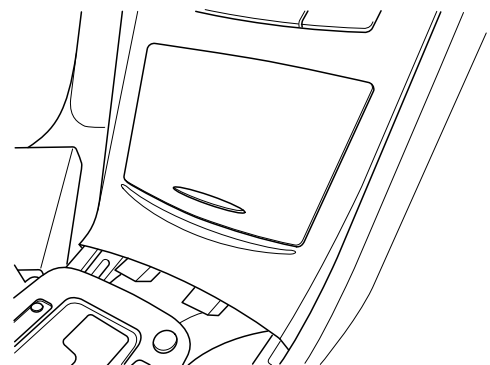


6. Disconnect the cigarette lighter connector.

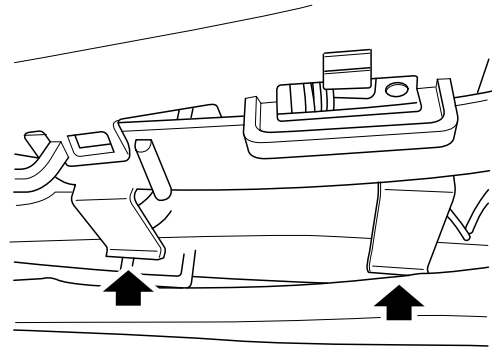
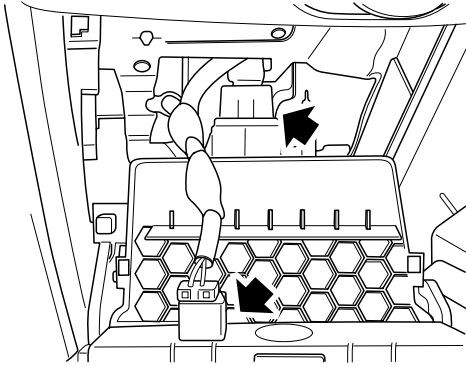


7. Using T52001, uniformly pry out the front trim panel and take it out.

Caution: *Be careful when removing the trim panel, and prevent the trim panel from damage caused by scratching.*

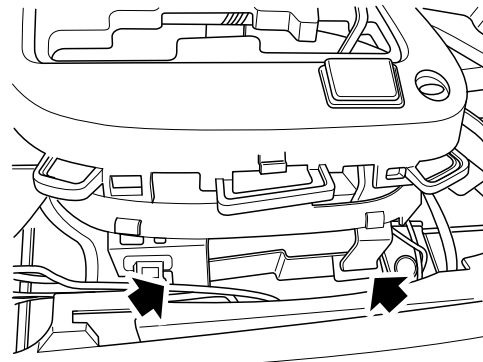
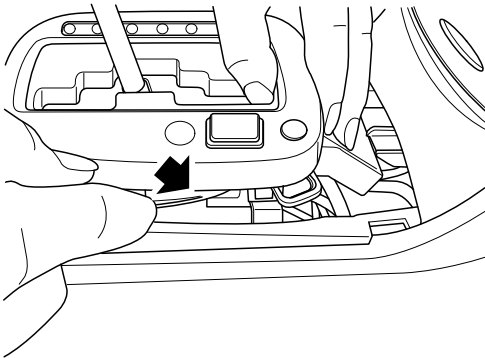


8. Disconnect the connectors of the hazard warning light switch and USB data line.



9. Using T52001 uniformly loosen the 4 snap fits on the gear panel housing and the upper cover.

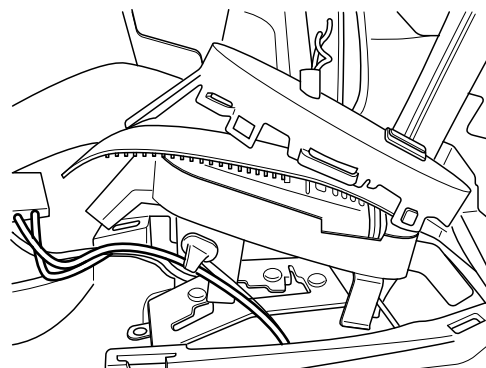
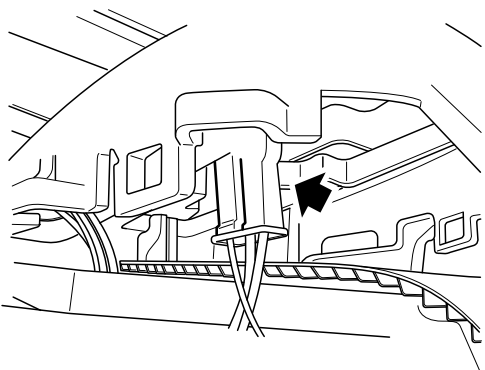
Caution: Operate carefully, DO NOT break the snap fits of the housing.



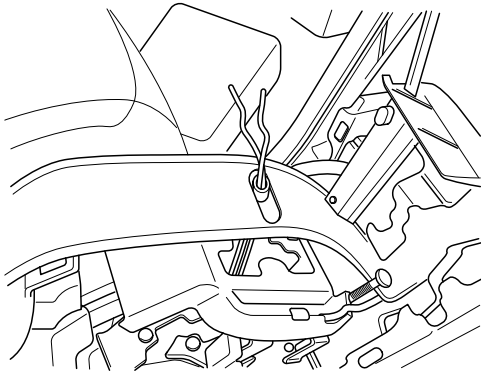
12. Disengage the panel from the shift lever by pulling the wire carefully, remove the dust excluder and 2 sliding blades.

Caution: DO NOT pull the wire harness forcefully to prevent each pin on the wire harness from loosening.

10. Disconnect the connector of the gear position display circuit board.

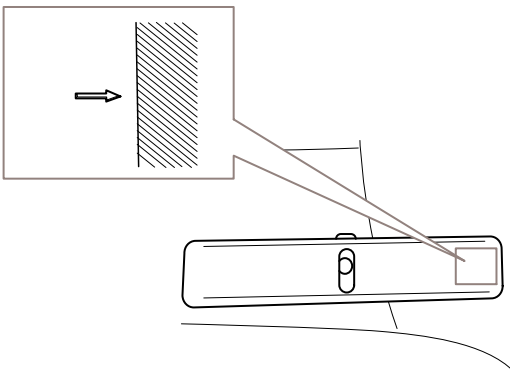


11. Using T52001, loosen the 4 claws from the upper cover to the shift lever housing.



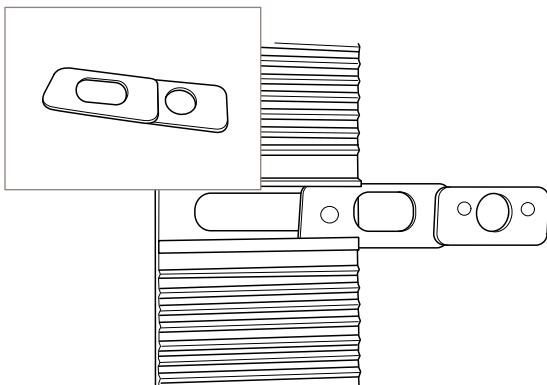
Refit

1. Check that the dust excluder faces forward when fitting it, the arrow direction and P direction of the panel are the same.



2. Make sure all the glossy surfaces of the sliding plates are facing upward, place the oval hole plate between the boot and the circular hole plate and insert it into the guide.

Caution: Note the overlapping order and the inserting direction between the sliding plates, the hole on the sliding plate should be close to the edge of the boot hole after being inserted.



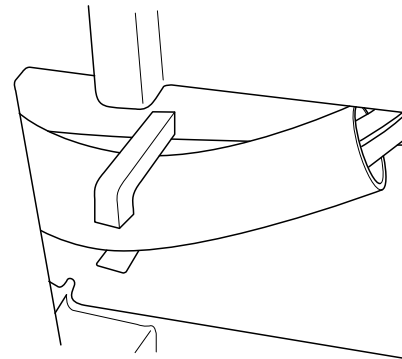
3. It goes through the shift lever through the holes on the boot and the sliding plate and attaches on the groove

of the upper cover.

4. Engage the panel to the upper cover by pulling it through the shift lever.

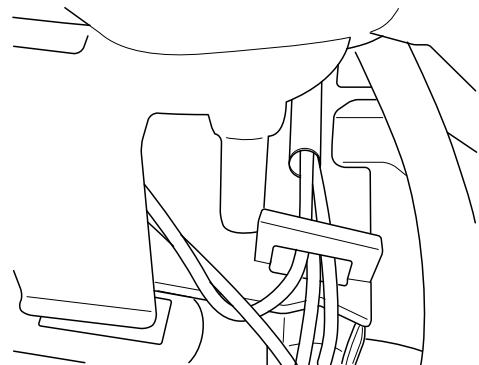
Caution: Operate carefully, DO NOT pull the wire forcefully to prevent each pin on the wire from loosening.

5. Connect the connector of the gear position display circuit board, and hearing a "click" sound indicates it is fitted to the proper position.
6. Make sure the wires are in the original position and fix them correctly.

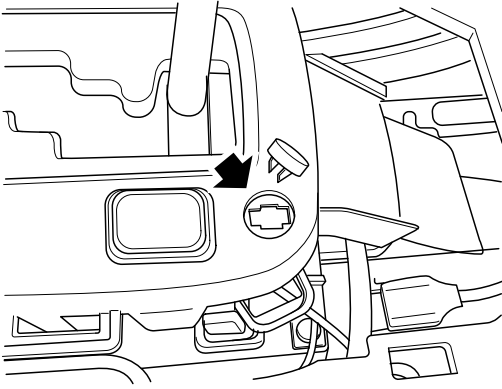


7. Check if the P lock valve release panic device jack is correctly assembled during fitting.

Caution: Release the correct insertion of the P lock valve panic device.



8. Engage the upper cover to the shift lever assembly housing.
9. Insert the mechanical key into the emergency unlock hole of P position, ensure that the shift lever can change from P to other gears normally, and move the shift lever to each position in order, check that the dust excluder, sliding plates are smooth and not scored during shifting.



10. Fit the connection gaiter to the shift lever, align the hole on the gaiter with the hole on the shift lever, then hearing a "click" sound indicates the housing is fitted to the proper position.
11. According to the mark made before, insert the wire connector to the wire holder with T84001.

Caution: *Align the protruding point of the wire pin with the groove in the wire holder.*

12. Check if the pin is secured to the wire holder tightly by pulling the wire holder slightly.
13. Fit the wire holder into the connection gaiter and put it in position.
14. Connect the connectors of the hazard warning light switch and USB data line, fit the front trim panel.
15. Connect the cigar lighter connector, then fit the centre console trim panel and the gear panel trim ring.
16. Fit the shift lever knob.

Automatic Shift Lever Knob Refit

Gear Position Panel

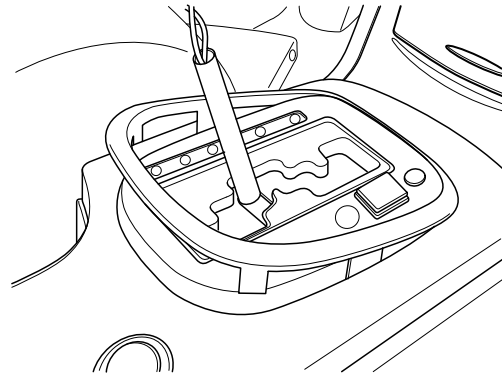
Removal

1. Remove the shift lever knob.

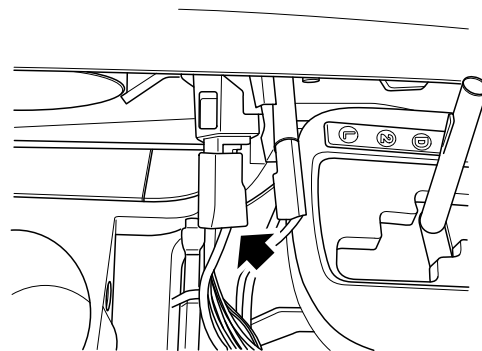
Automatic Shift Lever Knob Removal

2. Using T52001, uniformly pry out the panel trim ring and the centre console trim panel.

Caution: *Be careful when removing the trim panel, and prevent the trim panel from damage caused by scratching.*

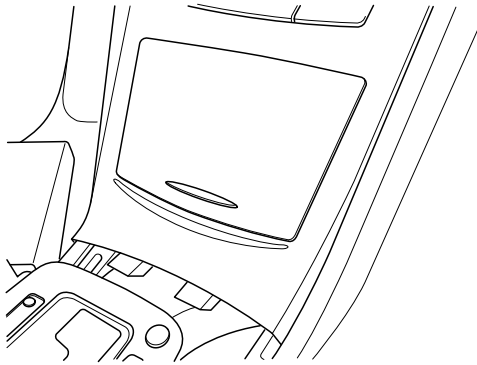


3. Disconnect the cigarette lighter connector.

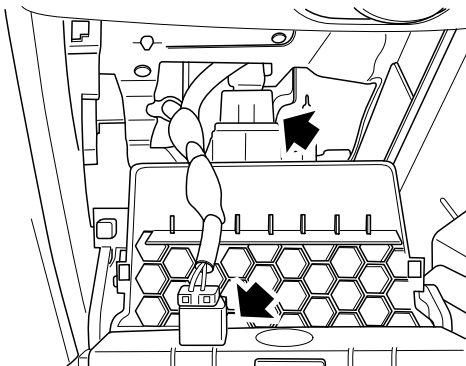


4. Using T52001, uniformly pry out the front trim panel and take it out.

Caution: *Be careful when removing the trim panel, and prevent the trim panel from damage caused by scratching.*

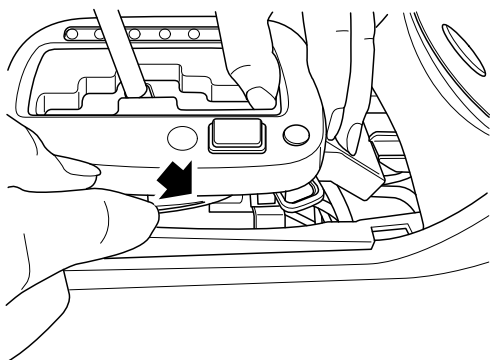


5. Disconnect the connectors of the hazard warning light switch and USB data line.



6. Using T52001 uniformly loosen the 4 snap fits on the panel housing and the upper cover.

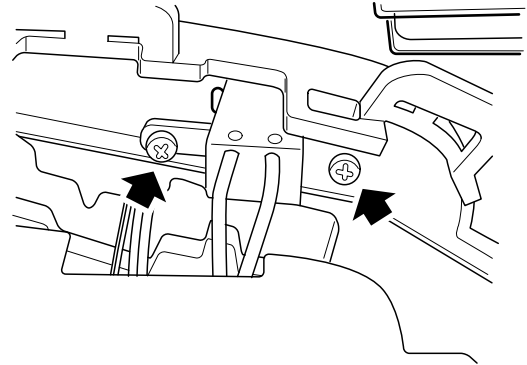
Caution: Operate carefully, DO NOT break the snap fits of the housing.



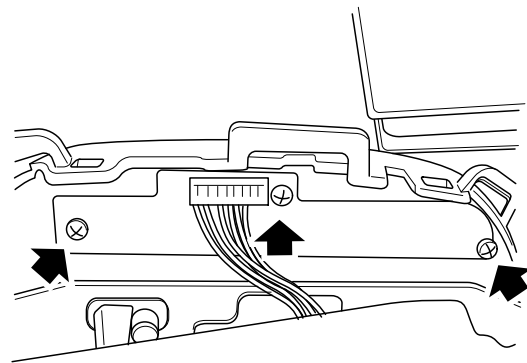
7. Disconnect the connector of the gear position display circuit board.
8. Using T52001, loosen the 4 claws from the upper cover to the shift lever housing.
9. Tow the wire harness carefully to detach the panel from the shift lever.

Caution: DO NOT pull the wire harness forcefully to prevent each pin on the wire harness from loosening.

10. Loosen the 2 self-tapping screws securing the mode switch to the panel.



11. Loosen the 3 self-tapping screws securing the gear position display circuit board to the panel.



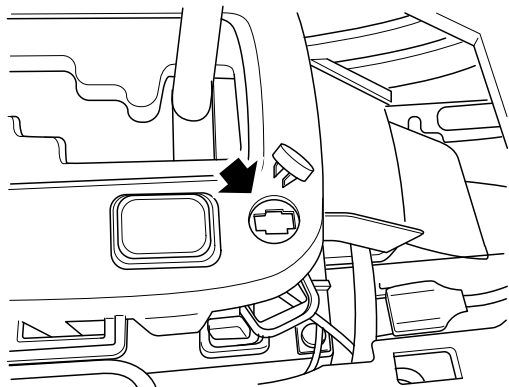
12. Remove the gear position panel.

Refit

1. Position the gear position display circuit board to the panel and tighten the 3 self-tapping screws to **0.5-1 Nm**.
2. Position the mode switch to the panel and tighten the 2 self-tapping screws to **0.5-1 Nm**.
3. Connect the connector of the gear position display circuit board, and hearing a "click" sound indicates it is fitted to the proper position.
4. Engage the panel into the upper cover.
5. Arrange the wire harness as it was and secure it properly.

Caution: Operate carefully, DO NOT pull the wire forcefully to prevent each pin on the wire from loosening.

6. Insert the mechanical key into the emergency unlock hole of P position, ensure that the shift lever can change from P to other gears normally, and move the shift lever to each position in order, check that the dust excluder, sliding plates are smooth and not scored during shifting.



7. Connect the connectors of the hazard warning light switch and USB data line.
8. Fit the front garnish.
9. Connect the cigarette lighter connector.
10. Fit the panel trim ring and the centre console trim panel.
11. Fit the shift lever knob.

 **Automatic Shift Lever Knob Refit**

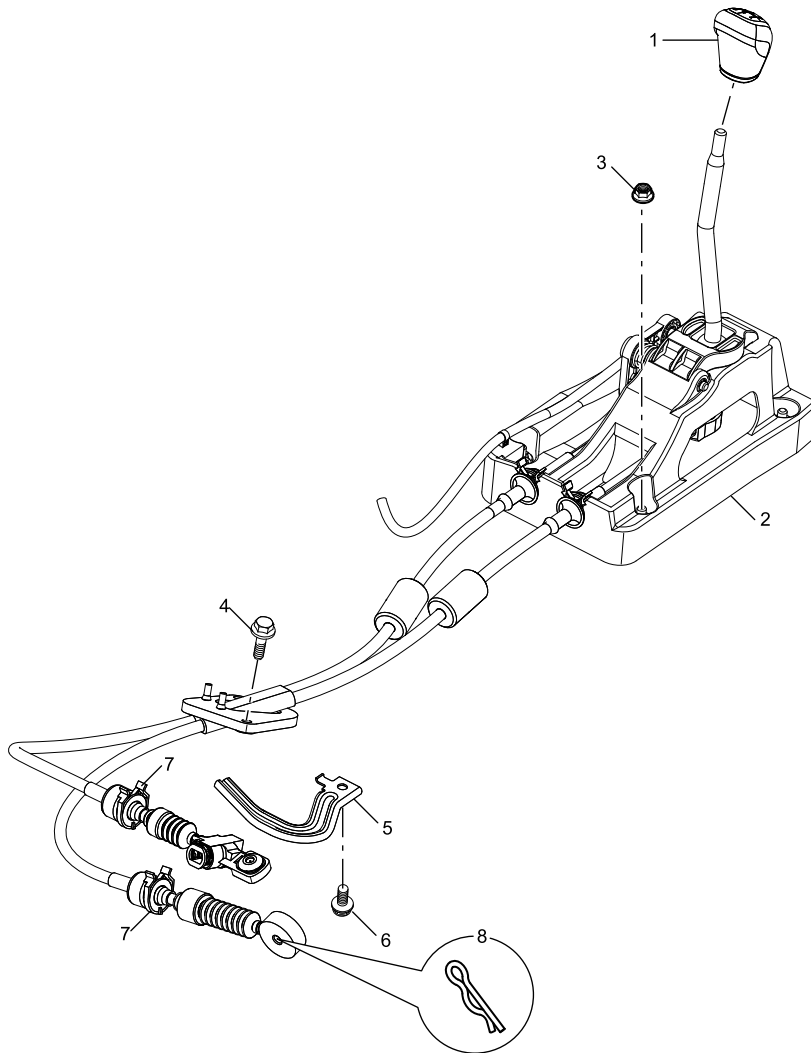
Shift Lock Control-MT**Specifications****Torque**

| Description | Value |
|--------------------------------------|----------|
| Nut - Manual Shift Mechanism to Body | 19-25 Nm |
| Bolt - Shift Cable to Body | 19-25 Nm |

Description and Operation

Description and Operation

System Component Layout



- | | |
|---|--|
| 1. Shift Knob | 5. Bracket - Gear Shift Cable |
| 2. Manual Shift Operating Unit and Gear Shift Cable | 6. Screw - Cable Support Bracket |
| 3. Nut - Shift Mechanism to Centre Path | 7. Snap Fit - Gear Shift Cable |
| 4. Bolt - Gear Shift Cable to Body | 8. Lock Pin - Shift Cable to Manual Transmission |

Service Procedures

Shift Lever Knob - Manual

Removal

1. Switch the shift lever to neutral.
2. Unscrew the shift lever knob.

Refit

1. Fit the shift knob to the shift lever. Rotate 4-6 more turns when the torque increases suddenly, firmly press the dust cover and make the gear marks point straight ahead.

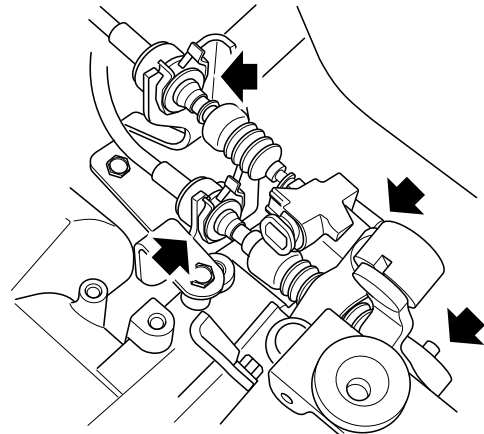
Shift Lever Assembly - Manual

Removal

1. Unscrew the shift lever knob.
2. Remove the centre console assembly.

Centre Console Assembly Removal

3. Remove 4 nuts securing the shift mechanism assembly to the body.
4. Loosen the 2 bolts securing cable to the body.
5. Notice the mounting position, release the lock pin from the manual transmission shift rocker arm and release the cable ball joint from the gear shift rocker arm.



6. Release the clamp securing the gear shift cable to the cable bracket.
7. Release the snap fit securing the hand brake switch wire harness to the shift mechanism.
8. Remove the shift mechanism assembly.

Refit

1. Position the shift mechanism assembly to the body, fit and tighten the nut to **19-25 Nm**.
2. Fix the hand brake switch wire harness to the shift mechanism.
3. Fit 2 bolts securing the cable to the body, and tighten to **19-25 Nm**.
4. Clip the cable onto the cable support bracket.
5. Fix the gear shift cable to the cable bracket with a clamp.
6. Connect the cable ball joint to the gear shift rocker arm and insert the lock pin into the manual transmission shift rocker arm.
7. Fit the centre console assembly.

Centre Console Assembly Refit

8. Fit the shift knob to the shift lever. Rotate 4-6 more turns when the torque increases suddenly, firmly press the dust cover and make the gear marks point straight ahead.

Transmission-AT

Specifications

Torque

| Description | Value |
|--|--------------|
| Nut - Neutral Start Switch | 5.9-7.8 Nm |
| Bolt - Neutral Start Switch to Automatic Transmission | 4.3-6.5 Nm |
| Nut - Shift Rocker Arm to Neutral Start Switch | 14-20 Nm |
| Bolt - Automatic Transmission Mounting Bracket to Automatic Transmission | 50-60 Nm |
| Bolt - Engine to Automatic Transmission | 75-90 Nm |
| Nut - Automatic Transmission Mounting Bracket to Suspension | 90-110 Nm |
| Bolt - Lower Tie Rod to Lower Tie Rod Mounting Bracket | 90-110 Nm |
| Bolt and Nut - Lower Tie Rod to Front Sub Frame | 70-90 Nm |
| Bolt - Drive Plate to Hydraulic Torque Converter | 25-35 Nm |
| Nut - Air Cleaner Bracket to Body | 5-7 Nm |
| Bolt - Air Cleaner Bracket to Body | 5-7 Nm |
| Bolt - Battery Tray to Body | 40-50 Nm |
| Oil Drain Plug | 14.7-19.6 Nm |
| Nut - TCM to Bracket | 4 Nm |
| Bolt - Input Speed Sensor | 3.9-6.9 Nm |
| Bolt - Output Speed Sensor | 11.7-14.3 Nm |
| Bolt - Automatic Transmission Filler Pipe Assembly | 7-9 Nm |
| Bolt - Valve Body Cover | 6-7.9 Nm |
| Bolt - Filter Assembly | 7.8-11.8 Nm |

Parameter
Transmission/Transaxle

| | |
|---------------------------------|---|
| Type | AISIN 81-40LE 4 speed Automatic Transmission (1.5VCT) |
| Stall Speed | Approximately 2400 rpm |
| Speed Ratio | |
| ·1st | 2.875 |
| ·2nd | 1.568 |
| ·3rd | 1.000 |
| ·4th | 0.697 |
| ·Reverse | 2.300 |
| ·Counter Shaft | 1.023 |
| ·Final Drive | 4.277 |
| Clutch | |
| ·C1 Forward Clutch | Plate: 4 Disc: 4 Flange: 1 |
| ·C2 Direct Clutch | Plate: 2 Disc: 2 Flange: 1 |
| ·C3 Reverse Clutch | Plate: 2 Disc: 2 Flange: 1 Cushion: 1 |
| Brake | |
| ·B1 O/D & 2nd Coast Brake | Plate: 1 Disc: 2 Flange: 2 |
| ·B2 2nd Brake | Plate: 2 Disc: 2 Flange: 1 |
| ·B3 1st & Reverse Brake | Plate: 4 Disc: 4 Flange: 1 |
| 1 way Clutch | |
| ·F1 1 way Clutch 1 | Wedge: 16 |
| ·F2 1 way Clutch 2 | Wedge: 28 |
| Solenoid | |
| ·Shift Solenoid Valve | 4: S1, S2, ST, SL |
| ·Linear Solenoid Valve | 1: SLU |
| ATF Type | JWS-3309 |
| ATF Volume - Drain and Refill | 5.65±0.2L |
| Line Pressure | |
| Idling: | |
| ·D | 0.37-0.41 Mpa |
| ·R | 0.59-0.68 Mpa |
| Stalling: | |
| ·D | 1.25-1.37 Mpa |
| ·R | 1.65-1.90 Mpa |
| ATF Oil Temperature Sensor (OT) | |
| 10°C | 5.626-7.303 kΩ |
| 25°C | 3.5 kΩ (reference value) |

Transmission**Transmission-AT**

| | |
|-------|----------------|
| 110°C | 0.224-0.271 kΩ |
| 145°C | 0.102-0.121 kΩ |

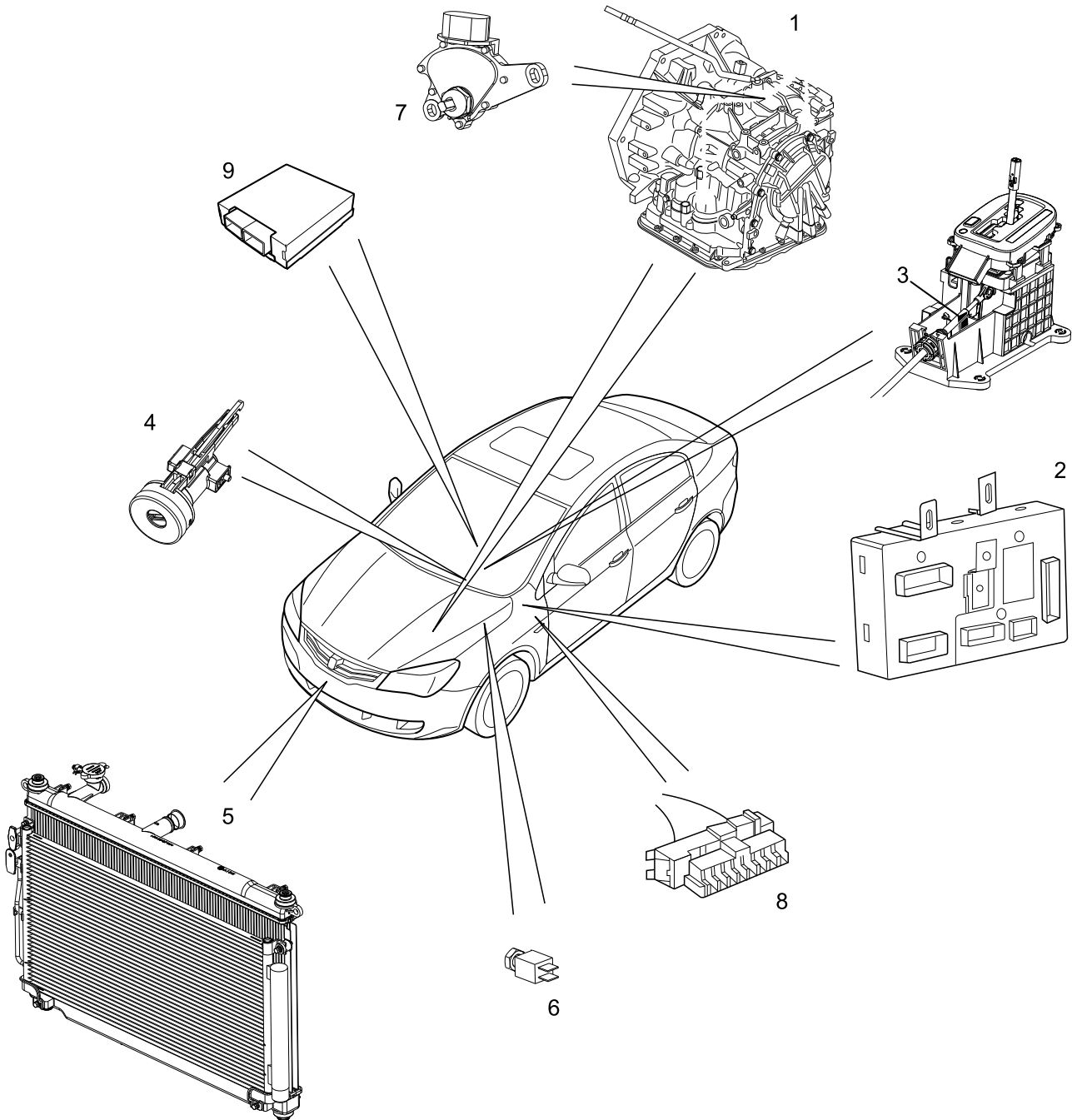
Gap

| Description | Gap |
|--|---------------|
| Automatic Transmission Case - Hydraulic Torque Converter | 17.3 mm |
| Oil Seal - Oil Pump Assembly | -0.15-0.15 mm |
| Oil Seal - Automatic Transmission Case End | 3.8-4.8 mm |
| Oil Seal - Torque Converter Housing End | 2.6-3.6 mm |

Description and Operation

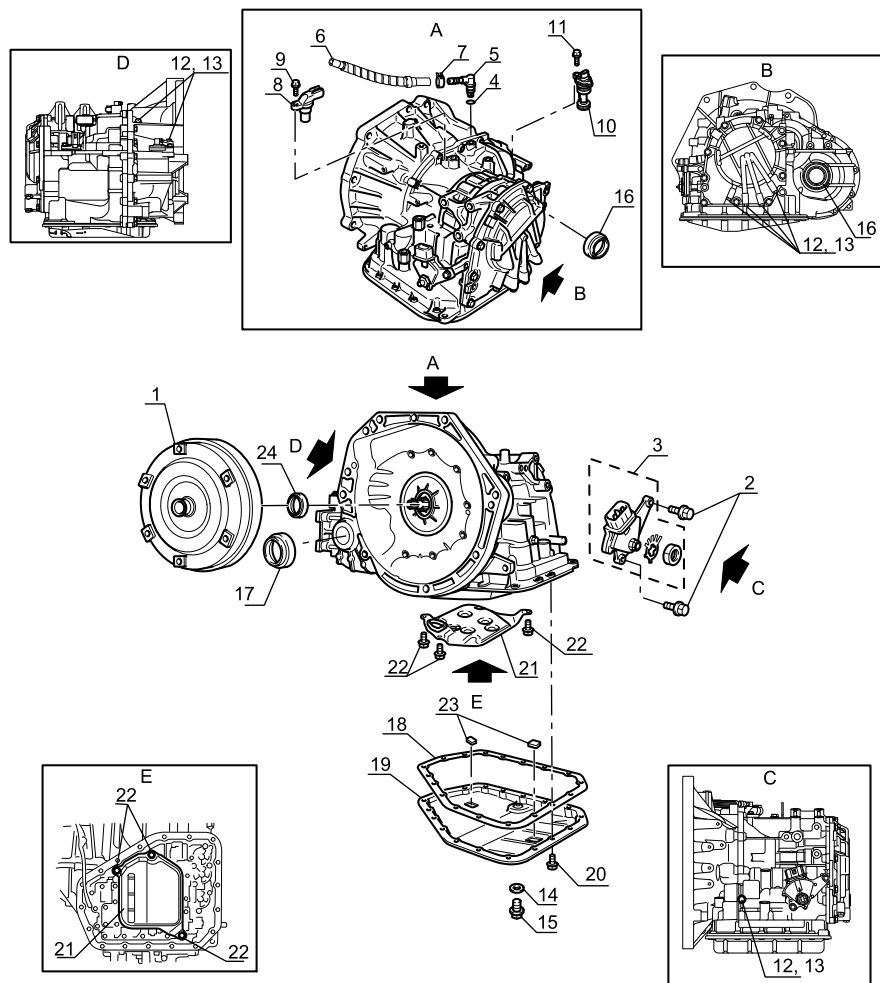
System Component Layout

Automatic Transmission Component Layout



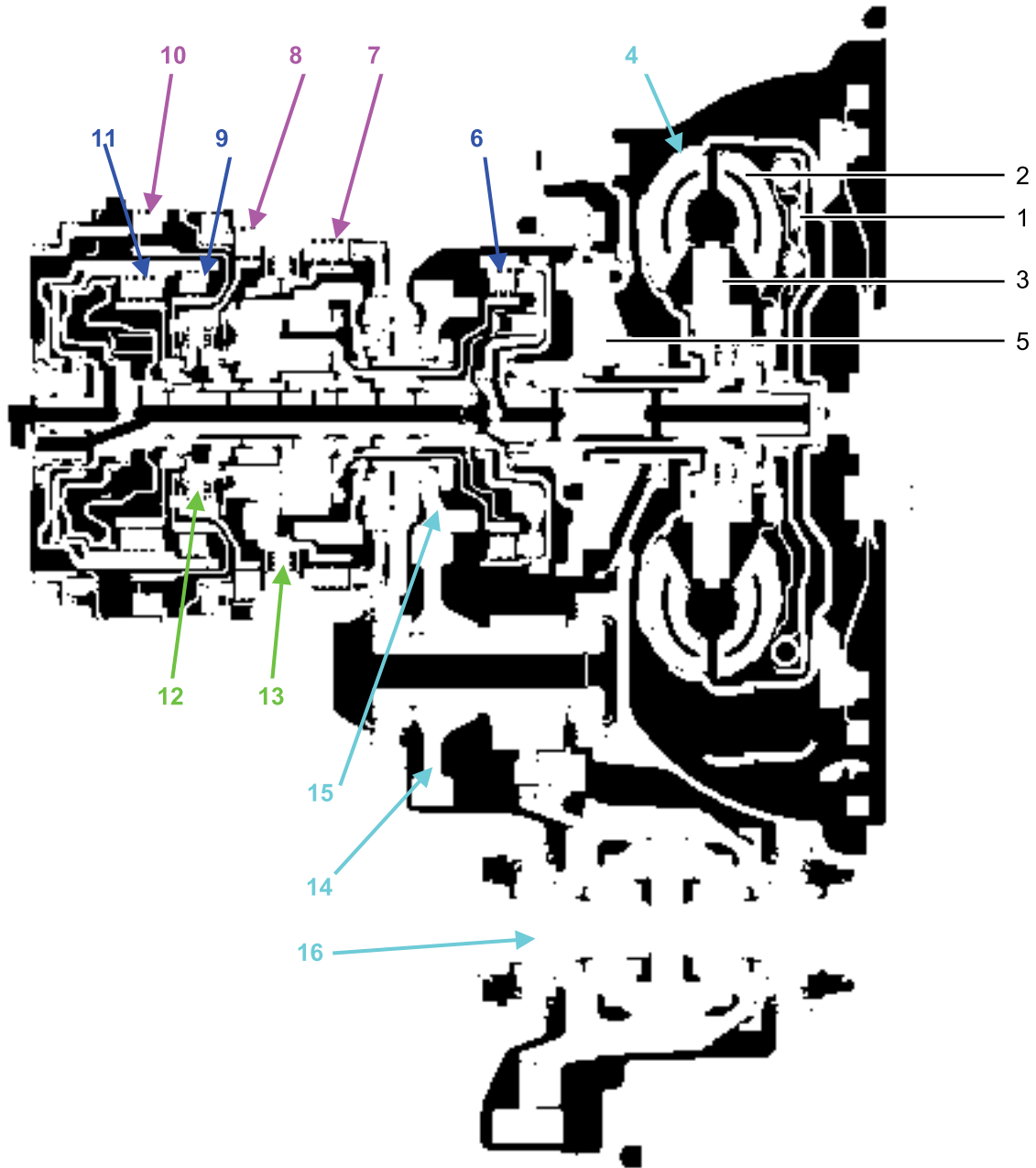
- | | |
|--|--|
| 1. Automatic Transmission | 6. Brake Pedal Switch |
| 2. Body Control Module (BCM) | 7. Neutral Start Switch (NSW) |
| 3. Gear Position Indicator, Mode Switch and OD OFF Switch, Shift Lever Lock Solenoid | 8. Diagnostic Socket |
| 4. Ignition Switch | 9. Automatic Transmission Control Module (TCM) |
| 5. Automatic Transmission Fluid (ATF) Cooler (Integrated into Radiator) | |

Automatic Transmission Accessory Component Layout



- | | |
|---|--|
| 1. Hydraulic Torque Converter Assembly | 13. O-ring - Automatic Transmission Fluid Hole Screw |
| 2. Bolt and Washer - Neutral Start Switch | 14. Shim - Automatic Transmission Drain Plug |
| 3. Neutral Start Switch (NSW) | 15. Automatic Transmission Drain Plug |
| 4. O-ring - Breather Plug | 16. Oil Seal-T Type - LH - Differential |
| 5. Automatic Transmission Breather Plug | 17. Oil Seal-T Type - RH - Differential |
| 6. Automatic Transmission Ventilation Tube | 18. Washer - Valve Body Cover |
| 7. Snap Fit - Automatic Transmission Ventilation Tube | 19. Automatic Transmission Valve Body Cover |
| 8. Input Speed Sensor - Automatic Transmission | 20. Bolt and Washer - Valve Body Cover |
| 9. Bolt and Shim - Input Speed Sensor | 21. Filter Assembly |
| 10. Output Speed Sensor - Automatic Transmission | 22. Bolt - Flange - Filter Assembly |
| 11. Bolt and Shim - Output Speed Sensor | 23. Magnet |
| 12. Automatic Transmission Fluid Hole Screw | 24. Oil Seal-T Type - Input Shaft |

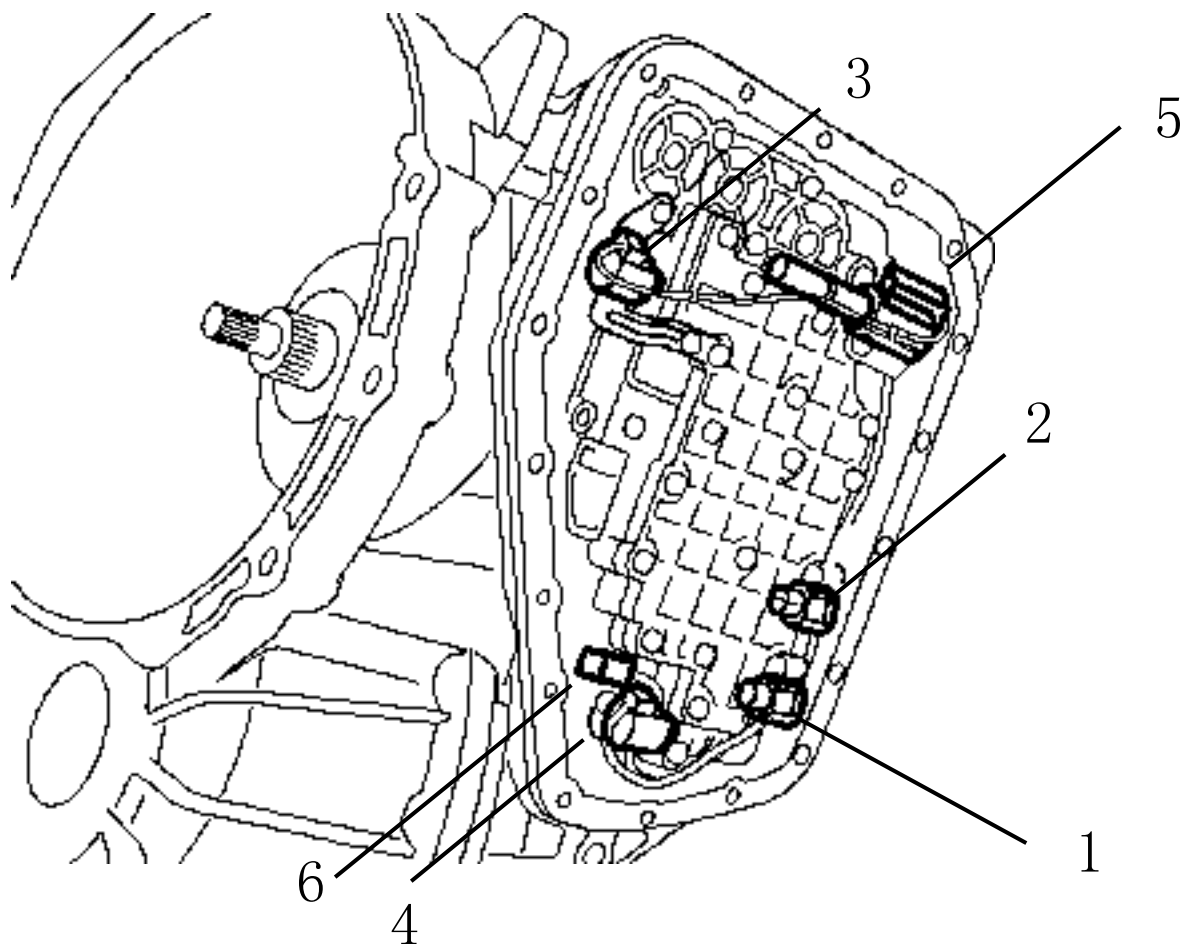
Automatic Transmission Section View



- 1. Hydraulic Torque Converter Lock-up Clutch
- 2. Pump Impeller
- 3. Stator
- 4. Impeller
- 5. Oil Pump
- 6. C2 Clutch
- 7. B3 Brake
- 8. B2 Brake

- 9. C3 Brake
- 10. B1 Brake
- 11. C1 Brake
- 12. F1 1 way Clutch
- 13. F2 1 way Clutch
- 14. Counter Shaft Driven Gear
- 15. Counter Shaft Drive Gear
- 16. Differential Assembly

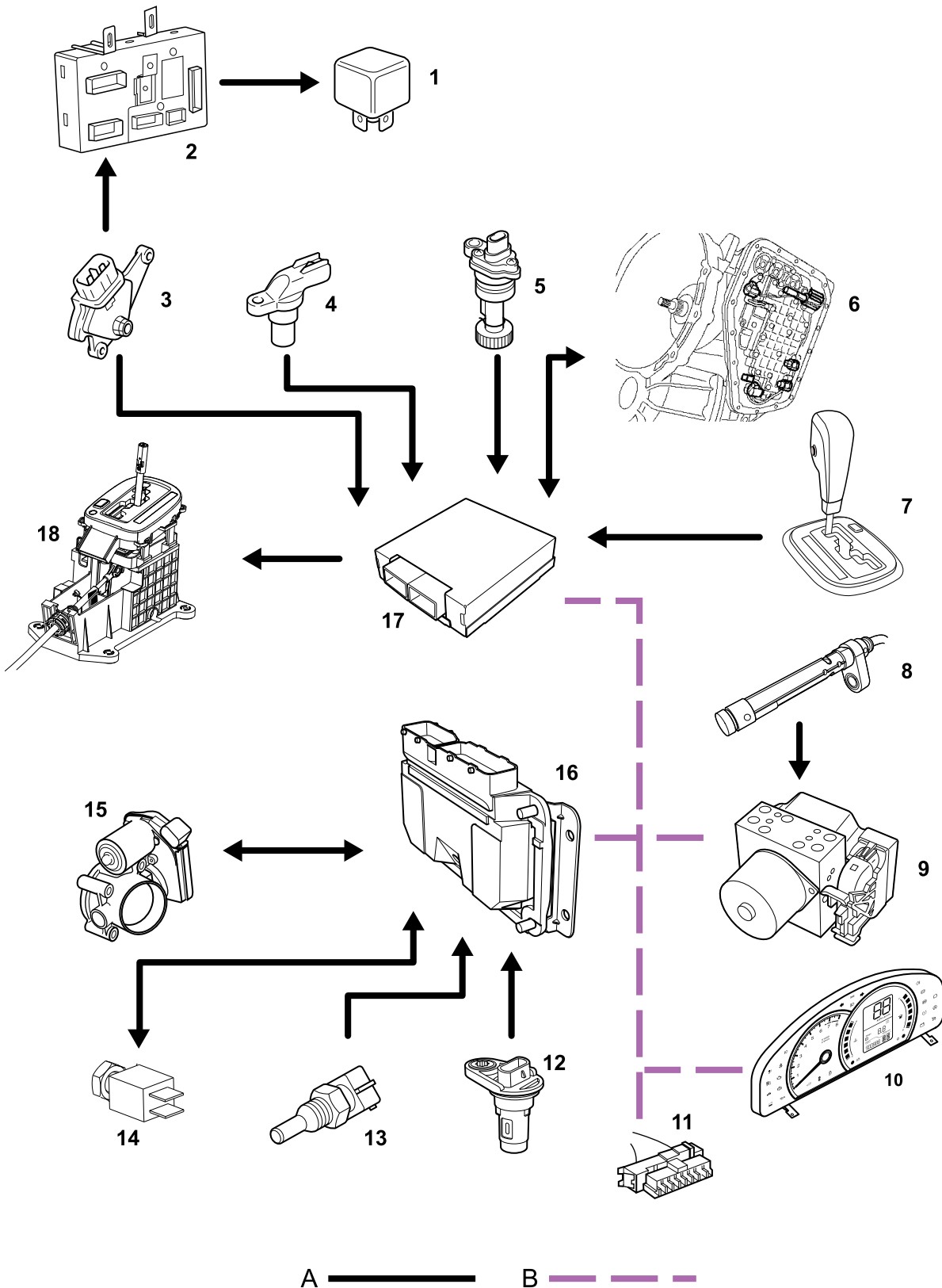
Solenoid Valve Assembly



- | | |
|---|---|
| 1. Shift Solenoid Valve (S1) | 4. Timing Solenoid Valve (ST) |
| 2. Shift Solenoid Valve (S2) | 5. Line Pressure Control Solenoid Valve (SLT) |
| 3. Lock-up Clutch Control Solenoid Valve (SL) | 6. Oil Temperature Sensor (OT) |

System Control Diagram

Automatic Transmission Control Diagram



A ————— B - - - - -

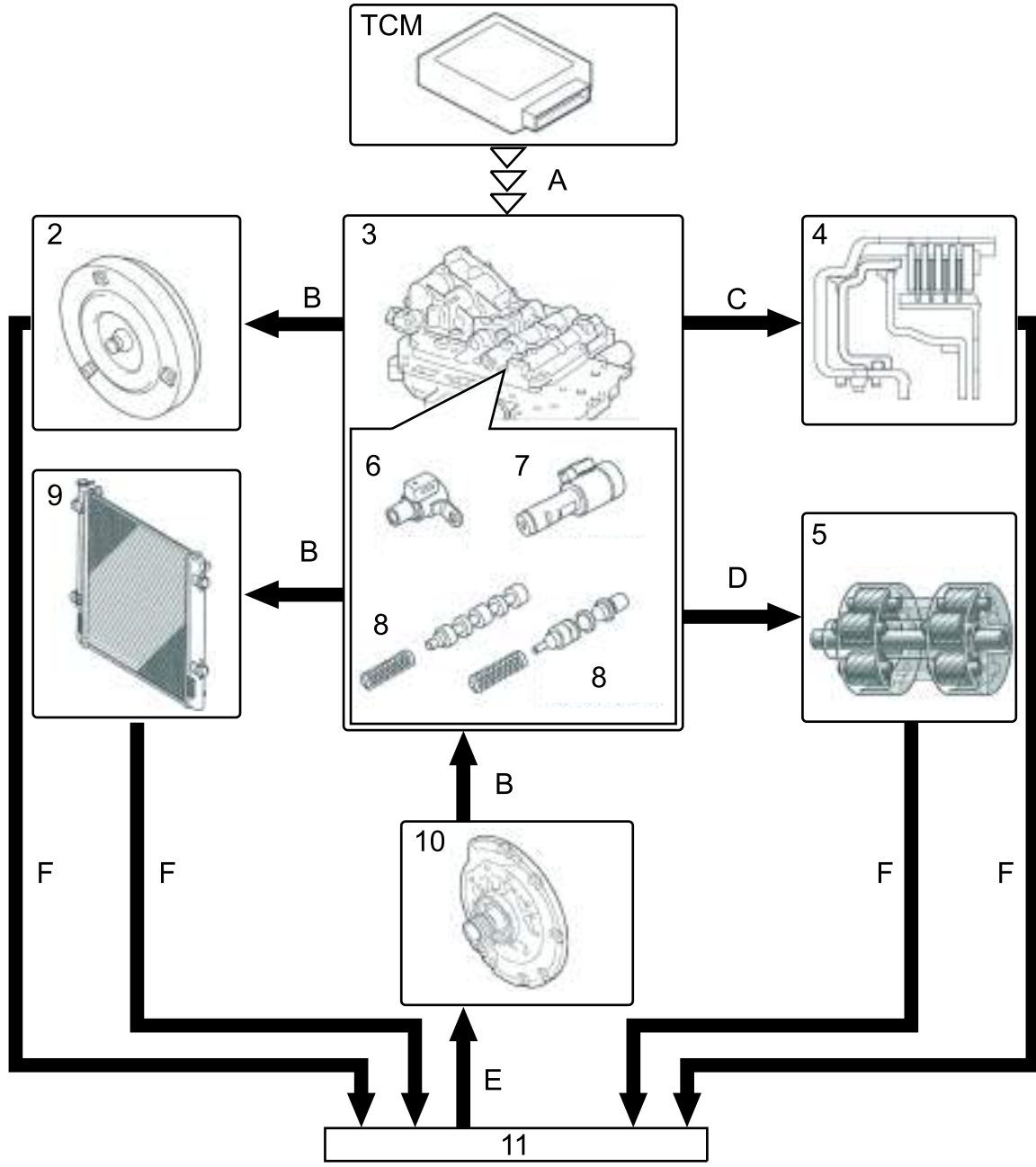
A = Hard Wire; B = CAN Bus Line;

- | | |
|-------------------------------|------------------------|
| 1. Starter Motor Relay (R7) | 4. Input Speed Sensor |
| 2. Body Control Module (BCM) | 5. Output Speed Sensor |
| 3. Neutral Start Switch (NSW) | 6. Valve Body Assembly |

- 7. Mode Switch, OD OFF Switch
- 8. Wheel Speed Sensor
- 9. ABS ECU
- 10. Instrument Pack
- 11. Diagnostic Socket
- 12. Crankshaft Position (CKP) Sensor

- 13. Engine Coolant Temperature (ECT) Sensor
- 14. Brake Pedal Switch
- 15. Electronic Throttle
- 16. Engine Control Module (ECM)
- 17. Automatic Transmission Control Module (TCM)
- 18. Gear Position Indicator, Shift Lock Solenoid

Hydraulic Pressure Control System



- | | |
|-------------------------------|--------------------------|
| 1. TCM | 7. Linear Solenoid Valve |
| 2. Hydraulic Torque Converter | 8. Regulator Valve |
| 3. Valve Body | 9. Oil Cooler |
| 4. Clutch, Brake | 10. Oil Pump |
| 5. Planetary Gear | 11. Valve Body Cover |
| 6. Shift Solenoid Valve | |

Description

General Description

The model is equipped with 8I-40LE electronic control 4 speed automatic transmission for AISIN AW. The transmission is used for front engine front drive vehicle, and the maximum input torque is 150 Nm.

TCM controls the system in a similar operation way with other **ECUs** fitted on the vehicle. It receives information from the sensors or other **ECUs** and performs calculations according to the pulse information stored in the **TCM** memory, and then outputs signals to each actuator or other **ECU**. The signals received from or send to other **ECUs** are mainly through the controller area network (**CAN**) bus line.

The diagnostic test can be performed by diagnostic interface. When some malfunctions occur in the transmission, **TCM** will store the related diagnostic trouble code (**DTC**), and these codes can be obtained again by using T5. Refer to "Diagnosis" for further details.

Diagnosis

The gear selection is performed by using the shift lever in the centre console. The shift lever provides the driver with 6 optional positions P (Park), R (Reverse), N (Neutral), D (Drive), 2 (1st and 2nd) and L (1st).

TCM controls the shift mode according to one of three sets of preprogrammed parameters that grouped to each driving mode.

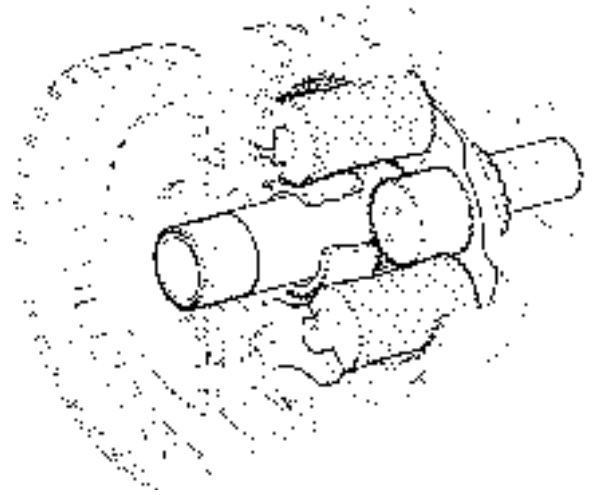
Available Mode:

- Economy (P)
- Snow (W)
- Sport (S)

After the vehicle starts, the current driving mode, selected gear and O/D status can be displayed in the instrument pack. If the economy mode is selected, that will not be displayed.

Transmission Assembly

Compared to the traditional automatic transmission with two groups of planetary gears, the 8I-40LE adopts only one group of lightweight and compact Ravigneaux planetary gear to achieve up-shift and down-shift, which makes the linkage much more simple and lightweight.



The Ravigneaux planetary gear has 2 sun gears, and pinions have different sizes in the same planetary gear unit, thus having more variable ratio compared to the traditional planetary gear unit.

Each gear speed ratio is obtained by the planetary gear set in the transmission case body. The single component in the planetary gear set is driven or locked by 3 clutches, 3 brakes and 2 I way clutches. The clutches, brakes and I way clutches control the engagement and rotation direction of the planetary gear set elements, thus producing "P" and "N" selection, 4 forward gear speed ratios and one reverse gear speed ratio. The power output of the powertrain will be transmitted to differential by the final drive.

Transmission Gear Speed Ratio

| Gear Position | Speed Ratio |
|---------------|-------------|
| 1st | 2.875 |
| 2nd | 1.568 |
| 3rd | 1.000 |
| 4th | 0.697 |
| Reverse | 2.300 |
| Final Drive | 4.277 |
| Counter Shaft | 1.023 |

Hydraulic Pressure Control System

Based on the hydraulic pressure produced by the oil pump, **TCM** sends signals to each solenoid. According to the driving conditions of the vehicle, these signals control the pressure that is applied to the hydraulic torque converter, planetary gear set, clutch and brake.

Valve Body Assembly

The transmission uses 5 solenoids located on the valve body. The solenoid is activated or disabled by **TCM**, controls the **ATF** flow (shift time sequence) supplied to the clutch, brake and hydraulic torque converter, lubrication and cooling. All the 5 solenoids can be classified into two groups by the

operation. Among them, one is linear control solenoid valve, and the other four are shift solenoid valves.

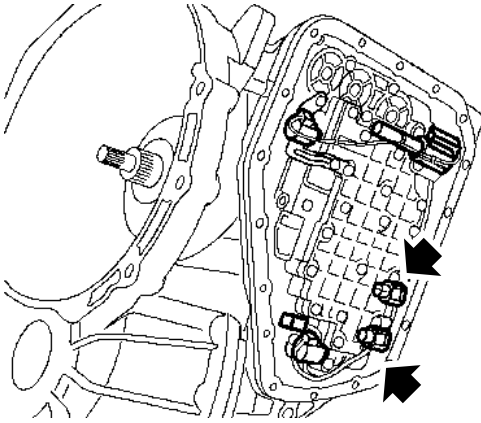
- Shift solenoid valve: S1, S2, ST, SL
- Linear solenoid valve: SLT

Each solenoid includes a internal coil and a needle valve. The needle valve is activated by the voltage that pass through the solenoid coil, and it opens and closes the hydraulic circuit. The shift solenoid closes the hydraulic circuit to match the current fluid flow. The linear control solenoid can linearly control the hydraulic circuit much better.

All the solenoid are powered by **TCM**, line pressure control solenoid valve (SLT) is grounded by **TCM**, lock-up clutch control solenoid valve (SL), timing solenoid valve (ST), shift solenoid valve (S1, S2) are grounded by valve body casing.

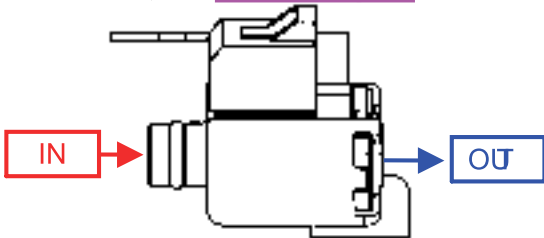
Solenoid Valve

Shift Solenoid Valve (S1, S2)



The 2 shift solenoids are directly fitted in the hydraulic pressure control valve body. The shift solenoid changes the shift solenoid S1, S2 normal open by operating the clutch and brake.

S1, S2 **Normal open**



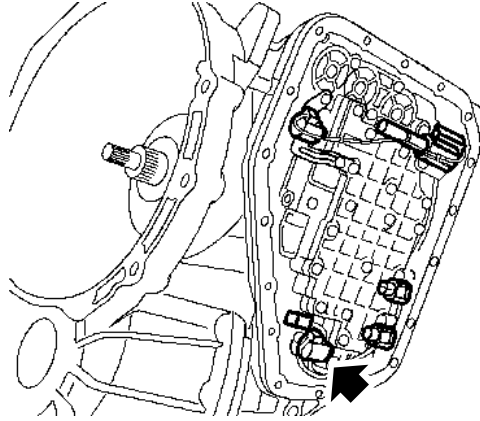
TCM controls the opening and closing of these solenoid to match the vehicle speed and throttle valve opening. The two solenoids achieve the different gears by the various opening and closing combination.

Shift Solenoid Operation Status

| Gear Position | S1 | S2 |
|---------------|----|----|
| 1st | ○ | ○ |
| 2nd | ○ | X |

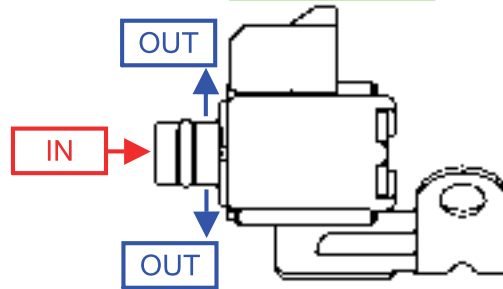
| | | |
|-----------------------------------|---|---|
| 3rd | X | X |
| 4th | X | ○ |
| X = Solenoid OFF; ○ = Solenoid ON | | |

Timing Solenoid Valve (ST)



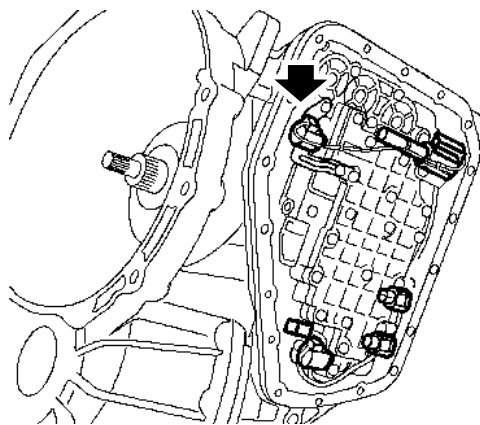
The timing solenoid valve is directly fitted in the hydraulic pressure control valve. The solenoid apply or drain the hydraulic flow that is applied on the CI clutch by operating the timing spool in the valve body.

Normal close

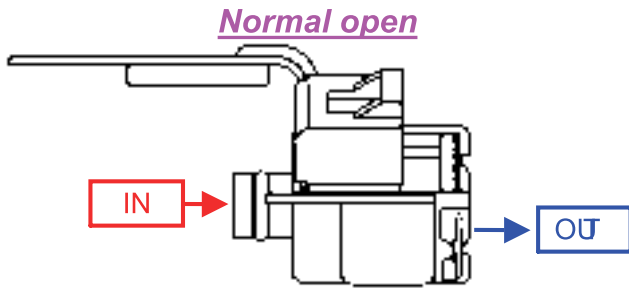


Timing solenoid valve (ST) is normal closed.

Lock-up Clutch Control Solenoid Valve (SL)



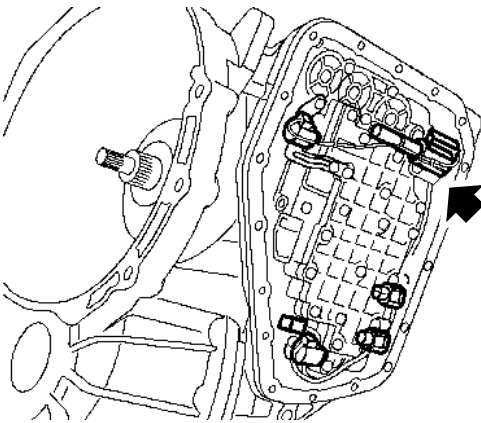
The lock-up clutch control solenoid valve (SL) controls the engagement and disconnection of the lock-up clutch in the hydraulic torque converter.



The lock-up clutch control solenoid valve (SL) is normal open.

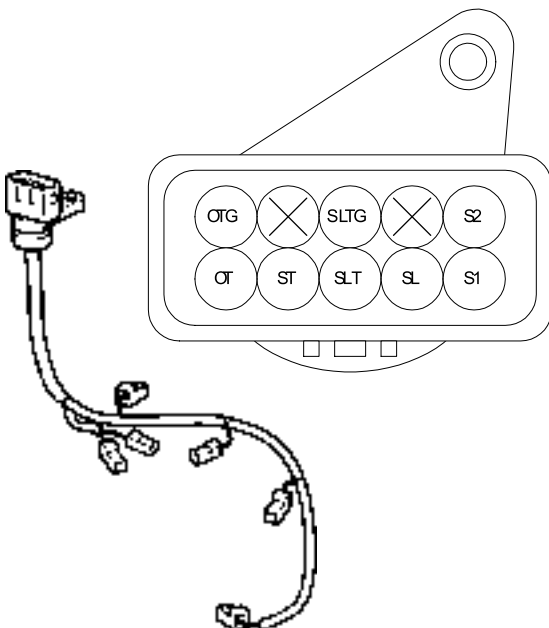
Line Pressure Control Solenoid Valve (SLT)

The linear control solenoid valve is used for regulating the line pressure, and accurately controlling the brake and clutch. The linear control solenoid valve operates depending on the signal received from **TCM**.



The line pressure control solenoid valve (SLT) linearly controls the line pressure of the clutch and brake to decrease the shift shock.

Valve Body Solenoid Wire Harness Assembly



The valve body solenoid wire combines the wire harnesses of shift solenoid (S1, S2), timing solenoid (ST), lock-up clutch control solenoid (SL), linear solenoid (SLT), **ATF** oil temperature sensor (OT) in a connector, which is fitted in the automatic transmission.

Hydraulic Torque Converter

The hydraulic torque converter is located in the hydraulic torque converter housing of the transmission case RH.

The hydraulic torque converter functions as combination of the engine and transmission. The power that output from the engine is transmitted to the transmission through the hydraulic pressure and mechanism (through hydraulic torque converter lock-up clutch in some certain gear positions and operation conditions). The hydraulic torque converter is connected to the engine through the drive plate.

The hydraulic torque converter consists of a pump impeller, a stator and a turbine. The engine drives the pump impeller, while the turbine drives the transmission. The stator is located on the I way clutch between the pump impeller and turbine.

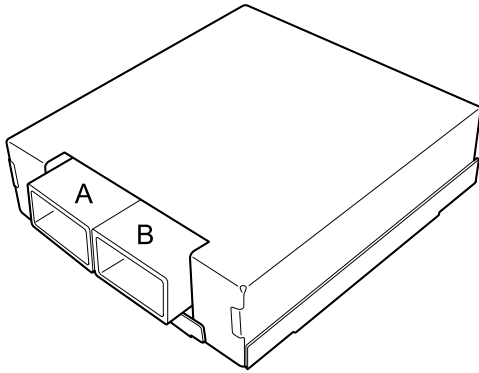
The fluid obtained by pump impeller is ejected into the turbine to allow it to rotate and transmit power. The stator changes the direction of the fluid that returns from the turbine, and makes it re-enter the pump impeller in the same rotation direction as the pump impeller and at the angle of optimal power transmission efficiency.

The I way clutch prevents the stator from moving back, making the accurate changing direction of the fluid be available. When the engine is idling, pump impeller transmits less fluid, and the turbine does not rotate, resulting in no power being transmitted to the transmission.

When the engine speed increases, much more fluid is ejected from the pump impeller to make the turbine start rotating. The turbine speed begins to increase with the engine speed increasing. The turbine speed becomes faster and faster, more and more fluid is ejected to the back of the stator, cause the stator to rotate in the same direction as the turbine. When the turbine speed is almost the same as pump impeller, the centrifugal force of both are almost equal, and all the three components generally rotate at the same velocity. This is called "Coupling Point".

The torque doubles in value or the drive velocity remains changing until the coupling point 1:1 reached. In order to obtain the power required for climbing up hills, the driver presses the accelerator pedal, and the hydraulic torque converter responds with increasing the torque amount. When driving on the flat road at cruising speed, less power is required. As a result, the hydraulic torque converter maintains the 1:1 speed ratio.

Transmission Control Module (TCM)



S262006

TCM is located on the dash panel at the driver side. It is connected with the automatic transmission wire harness by 2 connectors. The connector A has 24 pins, and connector B 26 pins.

TCM uses electrically erasable read only memory (**EEPROM**). So, the new or replaced **TCM** can be used to configure external **EEPROM** also makes **TCM** update the new information and special market data. In order to input new information, **TCM** must use T5 to perform the configuration. **EEPROM** can make **TCM** perform the configuration many times as needed to meet the continuously change of the parameters and regulations.

TCM stores the signal value of transmission sensor and actuator. These stored signals guarantee that the transmission can always obtain optimal performance. If the voltage of battery is low, for example, the battery discharges, the message will be lost. When the engine starts for the first time after the battery is discharged or disconnected, **TCM** returns to the default. The **EEPROM** in the **TCM** allows the stored value to be obtained again quickly.

Input and Output

The sensor signal enables **TCM** to monitor the status of transmission. **TCM** processes the signal and compares it with the stored data in the memory. If these signals are out of the parameters stored by **TCM**, **TCM** will regulate the operation of transmission by actuator to provide optimal drivability and other performances.

TCM regulates the operation of transmission by using the following actuators:

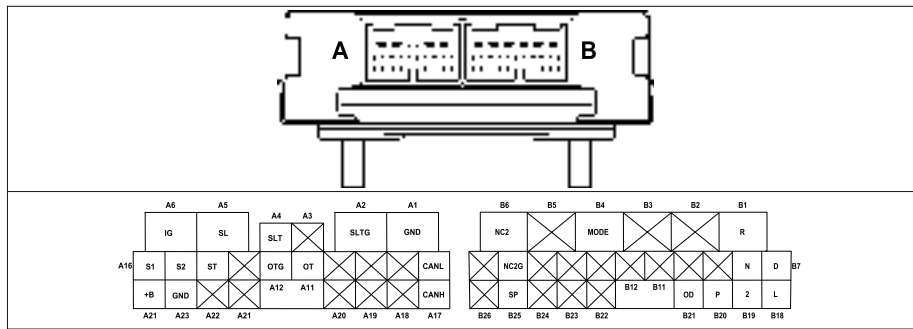
- Shift Solenoid Valve (S1, S2)
- Hydraulic Torque Converter Lock-up Clutch Solenoid Valve (SL)
- Line Pressure Control Solenoid Valve (SLT)
- Timing Solenoid Valve (ST)

TCM also can be connected with the following units via the CAN bus line:

- **ECM**
- **BCM**
- Instrument Pack
- Diagnostic Socket

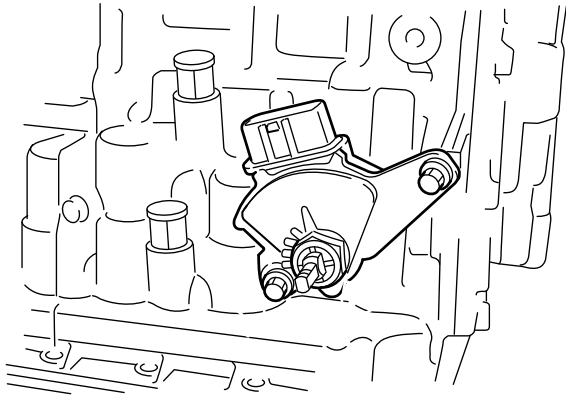
TCM receives the input signals of throttle opening angle, engine coolant temperature, engine speed, engine torque, brake switch and so on from **ECM**; **TCM** also receives the input signals of each contact point position of neutral start switch, input and output speed, **ATF** oil temperature, status of valve body solenoid, mode and ODOFF switches and so on. In addition, **TCM** outputs the torque decrease request, gear position information, malfunction warning messages to **ECM**, and outputs actuation signals to valve body solenoid, etc.

**Automatic Transmission Control Module (TCM)
Terminal**

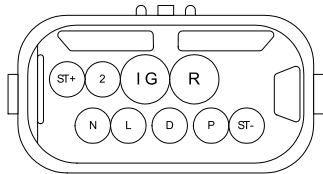


| Connector "A" | Connector "B" |
|--|-----------------------------|
| A1: Ground (-) | B1: "R" Signal (NSW) |
| A2: Line Pressure Control Solenoid Valve (-) | B2: Unused |
| A3: Unused | B3: Unused |
| A4: Line Pressure Control Solenoid Valve (+) | B4: Mode Switch |
| A5: Lock-up Clutch Solenoid Valve | B5: Unused |
| A6: Ignition Switch | B6: Input Speed Sensor (+) |
| A7: CAN Communication Signal (Low) | B7: "D" Signal (NSW) |
| A8: Unused | B8: "N" Signal (NSW) |
| A9: Unused | B9: Unused |
| A10: Unused | B10: Unused |
| A11: Oil Temperature Sensor (OT)(+) | B11: Unused |
| A12: Oil Temperature Sensor (OT)(-) | B12: Unused |
| A13: Unused | B13: Unused |
| A14: Timing Solenoid Valve | B14: Unused |
| A15: Shift Solenoid Valve (S2) | B15: Unused |
| A16: Shift Solenoid Valve (S1) | B16: Input Speed Sensor (-) |
| A17: CAN Communication Signal (high) | B17: Unused |
| A18: Unused | B18: "L" Signal (NSW) |
| A19: Unused | B19: "2" Signal (NSW) |
| A20: Unused | B20: "P" Signal (NSW) |
| A21: Unused | B21: O/D Mode Switch |
| A22: Unused | B22: Unused |
| A23: Ground (-) | B23: Unused |
| A24: Battery Voltage | B24: Unused |
| | B25: Vehicle Speed Signal |
| | B26: Unused |

Neutral Start Switch (NSW)



The neutral start switch is located on the manual valve select lever shaft at the front end of transmission. **TCM** accepts the voltage output provided by neutral start switch, informs **TCM** which gear the driver has selected.



| RANGE | STARTER CIRCUIT | | POSITION CIRCUIT | | | | | | |
|----------|-----------------|-----|------------------|---|---|---|---|---|---|
| | ST+ | ST- | IG | P | R | N | D | 2 | L |
| P | ○ | ○ | ○ | ○ | | | | | |
| R | | | ○ | | ○ | | | | |
| N | ○ | ○ | ○ | | | ○ | | | |
| D | | | ○ | | | | ○ | | |
| 2 | | | ○ | | | | | ○ | |
| L | | | ○ | | | | | | ○ |
| POLARITY | + | - | + | - | - | - | - | - | - |

TCM determines the position of the shift lever by monitoring the 6 sets of gear position contact points on the neutral start switch. Each set of contact point corresponds to 6 positions of shift lever respectively, and only one set always provides **TCM** with the voltage of battery, **TCM** monitors the output of the switch.

The electrical input of the neutral start switch passes through the fuse 8 for in fuse box of passenger compartment.

When the shift lever is in N or P position, the contact point ST can close the circuit. At this time, the starter motor relay (R7) can be controlled to engage by **BCM**, then the vehicle can be started.

Speed Sensor

- **TCM** uses the input of the following three speed signals to set the proper shift time sequence:
- Input Speed
- Output Speed
- Vehicle Speed

The transmission speed sensor is Hall type, and the generated square wave signal is converted into speed by **TCM**.

TCM collects the vehicle speed signals generated by **ABS** control module via **CAN** bus line.

Input Speed Sensor (NC2)



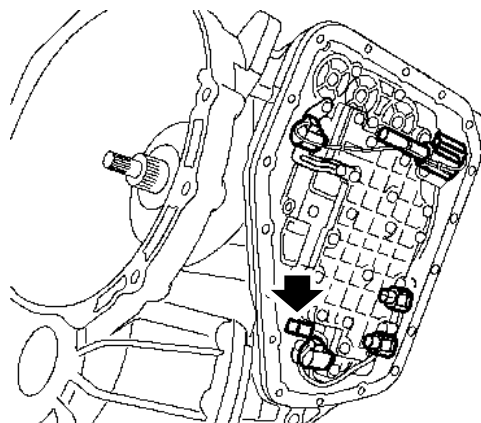
The magnetic resistance distributing ring on the C2 clutch drum rotates with the hydraulic torque converter driving the input shaft. When each gear tooth passes through the input sensor, the signals will be generated and sent to **TCM**.

Output Speed Sensor (SP)



The output speed sensor operates in the same way as the input speed sensor. But its signal is generated when the gear teeth on the sensor is driven by the drive gear on the differential.

Transmission Fluid Temperature Sensor



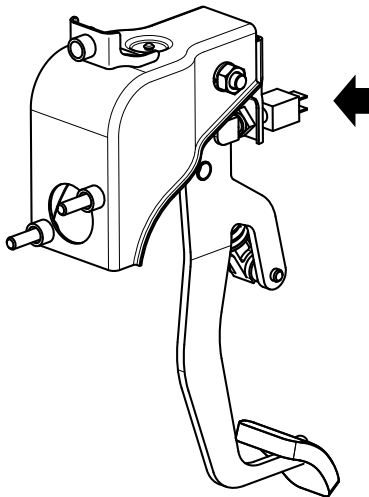
The fluid temperature sensor is located on the valve body in the transmission. **TCM** uses the fluid temperature sensor to monitor the fluid temperature of the transmission. The fluid

temperature sensor has an electrical output and grounded by **TCM**.

The fluid temperature sensor is a sensor with negative temperature coefficient. The resistance of the sensor decreases as the temperature increases. The resistance of the sensor increases as the temperature decreases. The variation of the resistance is proportional to the transmission fluid temperature. Using the resistance of the sensor, **TCM** calculates the transmission fluid temperature.

| Temperature (°C) | Resistance (k Ω) |
|------------------|--------------------------|
| 10 | 5.626-7.303 |
| (25) | (3.5) |
| 110 | 0.224-0.271 |
| 145 | 0.102-0.121 |

Brake Pedal Switch



The brake pedal switch is located on the pedal box in the driver's compartment. **TCM** monitors the status of the brake pedal by using the switch. **ECM** monitors the status of switch and transmits the data via **CAN** bus line to **TCM**.

If the brake pedal switch signal is malfunctioning:

- The shift lever cannot be shifted to other gear positions from P or N.
- The additional engine braking will not be produced.

Transmission Fluid Cooler

The transmission fluid cooler is located in the header for the radiator. The transmission and oil cooler are connected by the oil cooling pipe.

Controller Area Network (CAN) Bus Line

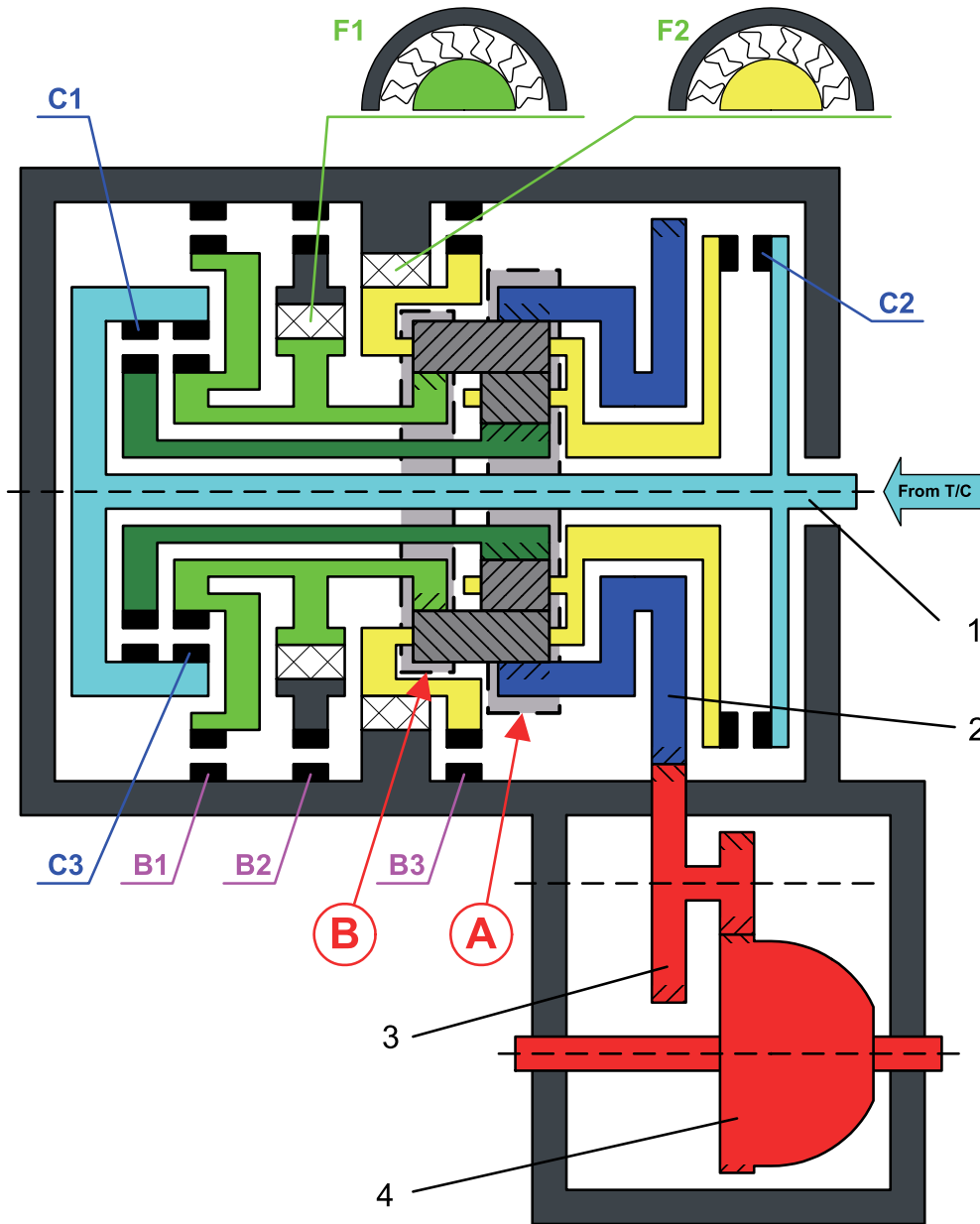
TCM communicates with other **ECUs** via **CAN** bus line, and performs the following controls:

- Shift Torque
- Engine Coolant Temperature
- Engine Torque and Speed

- Vehicle Speed
- Selected Gear Position
- Shift Information
- Engine Torque Decrease
- Engine Braking

Operation**Power Flow**

The following data shows the power flow in the transmission for each forward and reverse.



Data Note

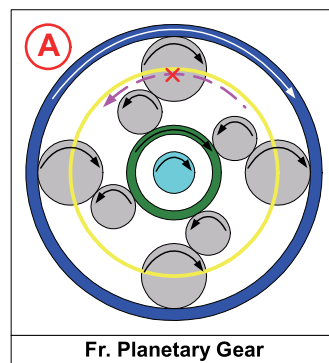
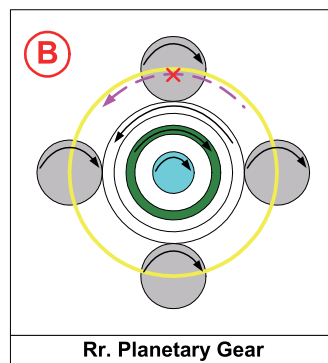
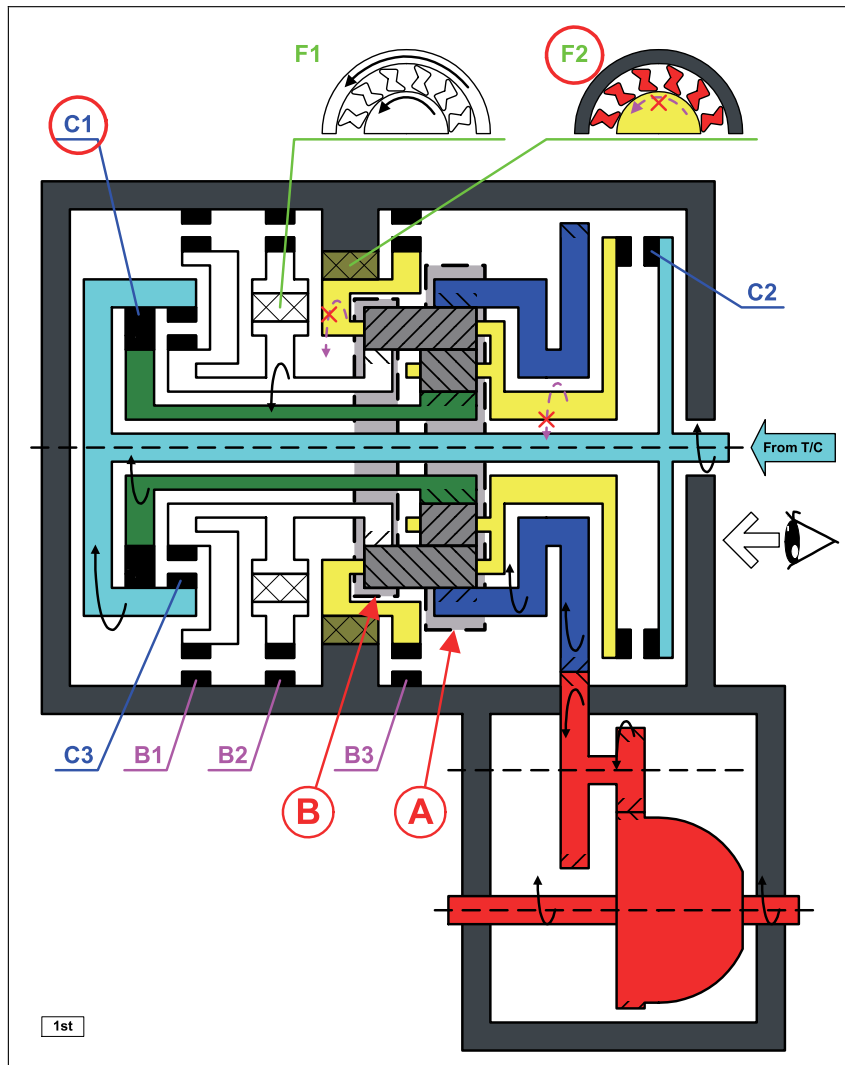
| Clutch, Brake and Planetary Gear Set | | Operation |
|--------------------------------------|---------------------------|---|
| 1 | Input Shaft | |
| 2 | Counter Shaft Drive Gear | |
| 3 | Counter Shaft Driven Gear | |
| 4 | Differential | |
| A | Front Planetary Gear Set | |
| B | Rear Planetary Gear Set | |
| C1 | Forward Clutch | Connect the counter shaft and front sun gear |
| C2 | Direct Clutch | Connect the input shaft and planetary carrier |
| C3 | Reverse Clutch | Connect the counter shaft and rear sun gear |
| B1 | O/D & 2nd Coast Brake | Lock the rear sun gear |
| B2 | 2nd Brake | Lock the rear sun gear |
| B3 | 1st & Reverse Brake | Lock the planetary carrier |
| F1 | 1 way Clutch 1 | Lock the rear sun gear turning counterclockwise when B2 is operating. |
| F2 | 1 way Clutch 2 | Lock the planetary carrier turning counterclockwise |

Components Operation

| POSITION | Solenoid | | | Clutch | | | Brake | | | 1 Way Clutch | |
|----------|----------|-----|-----|--------|----------|-----|-------|----------|-----|--------------|-----|
| | S1 | S2 | ST | C1 | C2 | C3 | B1 | B2 | B3 | F1 | F2 |
| P | ON | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF |
| R | V<9 | ON | ON | OFF | OFF | ON | OFF | OFF | ON | OFF | OFF |
| | V>=11 | ON | ON | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF |
| N | ON | ON | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF |
| D | 1st | ON | ON | OFF | ON | OFF | OFF | OFF | OFF | OFF | ON |
| | 2nd | ON | OFF | OFF | ON | OFF | OFF | ON | OFF | ON | OFF |
| | 3rd | OFF | OFF | OFF | ON | ON | OFF | OFF | ON | OFF | OFF |
| | 3<=>4 | OFF | ON | ON | ON<=>OFF | ON | OFF | OFF<=>ON | ON | OFF | OFF |
| | 4th | OFF | ON | OFF | OFF | ON | OFF | ON | ON | OFF | OFF |
| 2 | 1st | ON | ON | OFF | ON | OFF | OFF | OFF | OFF | OFF | ON |
| | 2nd | ON | OFF | OFF | ON | OFF | OFF | ON | ON | ON | OFF |
| | 3rd | OFF | OFF | OFF | ON | ON | OFF | OFF | ON | OFF | OFF |
| L | 1st | ON | ON | OFF | ON | OFF | OFF | OFF | ON | OFF | ON |
| | 2nd | ON | OFF | OFF | ON | OFF | OFF | ON | ON | ON | OFF |

D-1st

| Gear Position | | Solenoid | | | Clutch | | | Brake | | | I way Clutch | |
|---------------|-----|----------|----|-----|--------|-----|-----|-------|-----|-----|--------------|----|
| | | S1 | S2 | ST | C1 | C2 | C3 | B1 | B2 | B3 | F1 | F2 |
| D | 1st | ON | ON | OFF | ON | OFF | OFF | OFF | OFF | OFF | OFF | ON |
| | L | ON | ON | OFF | ON | OFF | OFF | OFF | OFF | ON | OFF | ON |



D-1st

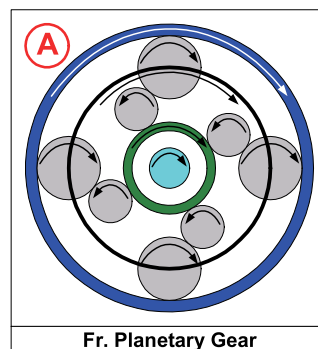
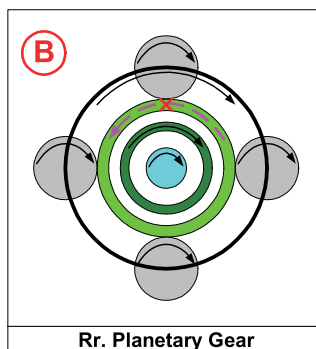
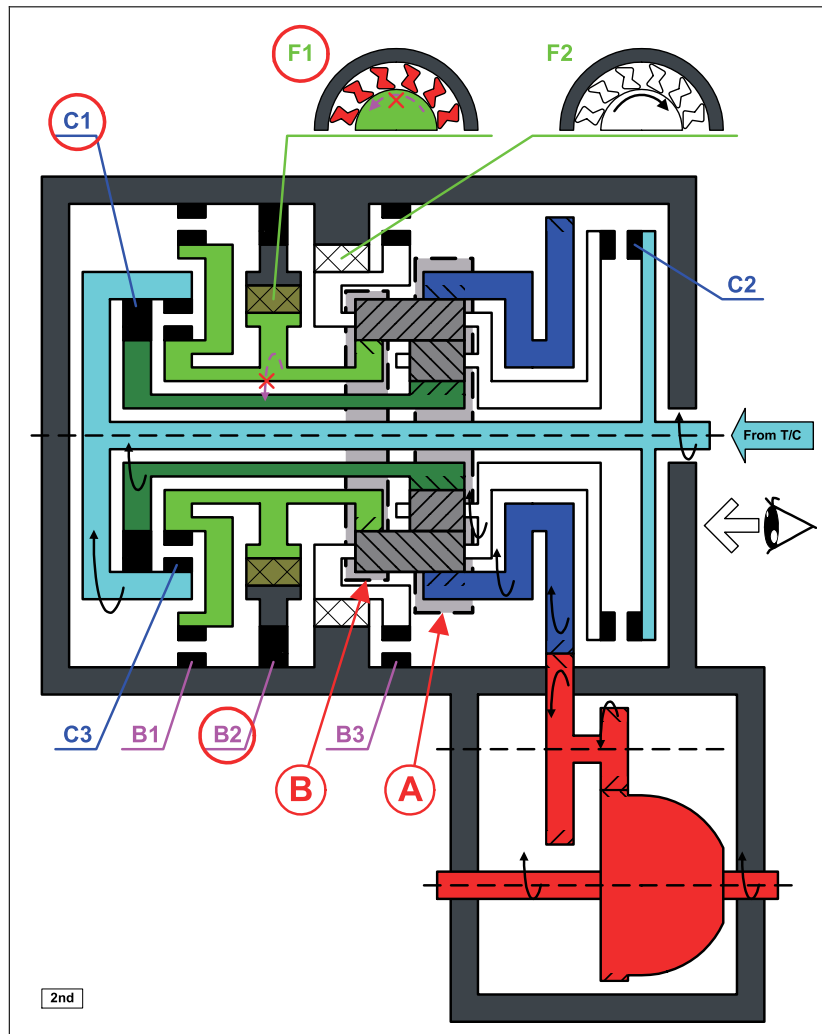
1. The input shaft turns clockwise. The forward clutch (C1) operates. Connect the input shaft to the front sun gear.
2. The front sun gear turns clockwise.
3. The short planetary gear rotates counterclockwise.
4. The long planetary gear rotates clockwise.
5. The planetary carrier turns counterclockwise. The 1 way clutch No.2 (F2) operates. (The planetary carrier turning counterclockwise is locked.)
6. The ring gear turns clockwise.
7. The counter shaft drive gear turns clockwise by the ring gear and counter shaft drive gear pair.
8. The counter shaft driven gear turns counterclockwise.
9. The drive bevel gear turns counterclockwise by the counter shaft driven gear and differential gear drive bevel gear pair.
10. The differential gear turns clockwise.

Engine Braking

1. The counter shaft drive gear and planetary ring gear turn counterclockwise.
2. The long planetary gear rotates counterclockwise, and the short planetary gear rotates clockwise.
3. The planetary carrier turns clockwise due to the long planetary gear rotates counterclockwise, but the drive force disappears due to the 1 way clutch NO.2 (F2) rotates freely. As a result, the engine braking does not operate.

D-2nd

| Gear Position | | Solenoid | | | Clutch | | | Brake | | | I way Clutch | |
|---------------|-----|----------|-----|-----|--------|-----|-----|-------|----|-----|--------------|-----|
| | | S1 | S2 | ST | C1 | C2 | C3 | B1 | B2 | B3 | F1 | F2 |
| D | 2nd | ON | OFF | OFF | ON | OFF | OFF | OFF | ON | OFF | ON | OFF |
| L | | ON | OFF | OFF | ON | OFF | OFF | ON | ON | OFF | ON | OFF |



D-2nd

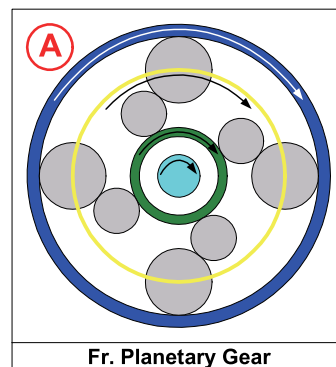
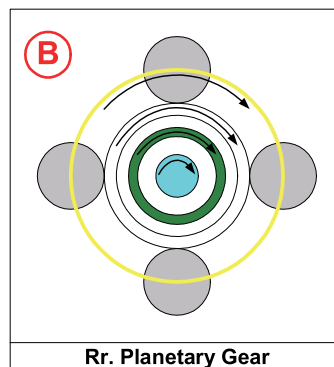
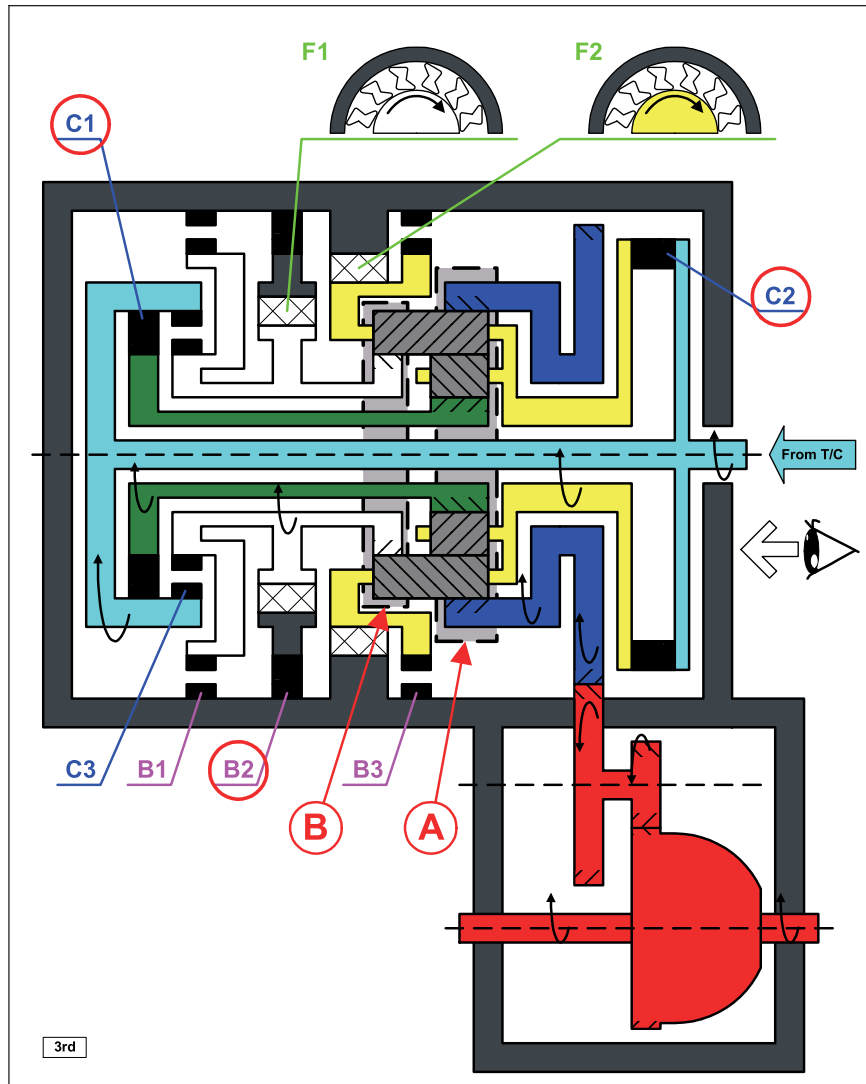
1. The input shaft turns clockwise. The forward clutch (C1) is engaged. Connect the input shaft to the front sun gear.
2. The front sun gear turns clockwise.
3. The short planetary gear rotates counterclockwise.
4. The long planetary gear rotates clockwise.
5. The rear planetary sun gear will turn counterclockwise. The 2nd brake (B2) and 1 way clutch No.1 operate, and the rear planetary sun gear turning counterclockwise is locked.
6. The planetary carrier turns clockwise by the reaction force of the long planetary gear.
7. The ring gear turns clockwise.
8. The counter shaft drive gear turns clockwise by the ring gear and counter shaft drive gear pair.
9. The counter shaft driven gear turns counterclockwise.
10. The differential gear drive bevel gear turns counterclockwise by the counter shaft driven gear and differential gear drive bevel gear pair.
11. The differential gear turns clockwise.

Engine Braking

1. The counter shaft drive gear and planetary ring gear turn counterclockwise.
2. The long planetary gear rotates counterclockwise.
3. The short planetary gear turns clockwise.
4. The rear sun gear turns clockwise due to the long planetary gear rotates counterclockwise, but the drive force disappears due to the 1 way clutch NO.1 rotates freely. As a result, the engine braking does not operate.

D-3rd

| Gear Position | | Solenoid | | | Clutch | | | Brake | | | I way Clutch | |
|---------------|-----|----------|-----|-----|--------|----|-----|-------|----|-----|--------------|-----|
| | | S1 | S2 | ST | C1 | C2 | C3 | B1 | B2 | B3 | F1 | F2 |
| D | 3rd | OFF | OFF | OFF | ON | ON | OFF | OFF | ON | OFF | OFF | OFF |



D-3rd

1. The input shaft turns clockwise.

The forward clutch (C1) is engaged. Connect the input shaft to the front sun gear.

The direct clutch (C2) is engaged. Connect the input shaft to the planetary carrier.

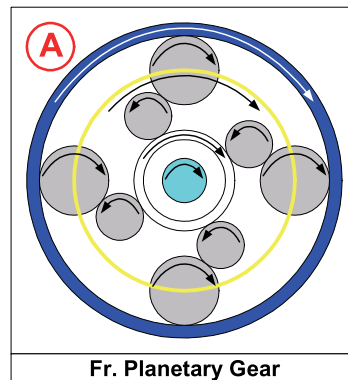
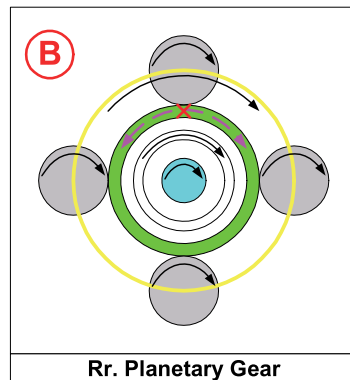
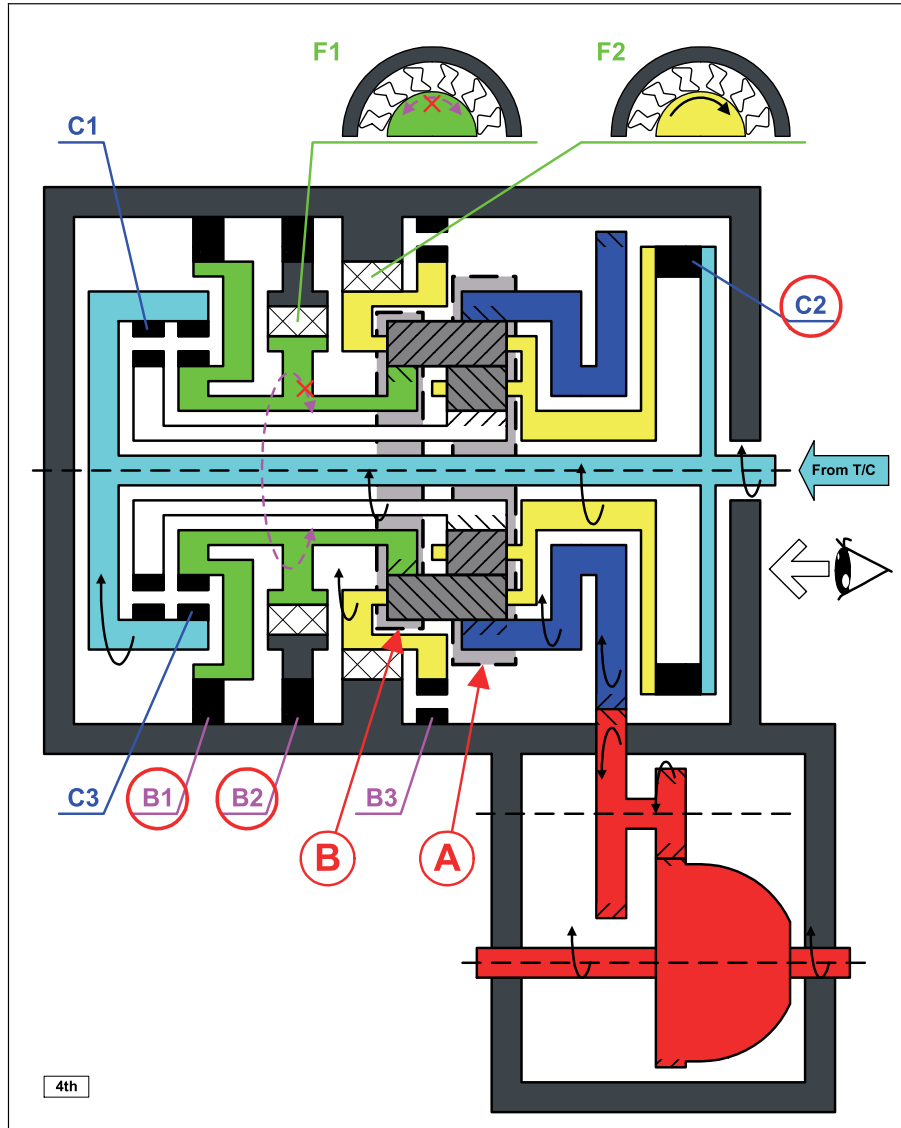
2. The short planetary gear and long planetary gear do not rotate on their own axis, but the planetary gear unit rotates clockwise as a whole.
3. The counter shaft drive gear turns clockwise by the ring gear and counter shaft drive gear pair.
4. The counter shaft driven gear turns counterclockwise.
5. The differential drive bevel gear turns counterclockwise by the counter shaft driven gear and differential drive bevel gear pair.
6. The differential turns clockwise.

Engine Braking

Without the assistance of the 1 way clutch, the drive force is input into the input shaft pair. Therefore, the engine braking operates.

D-4th

| Gear Position | | Solenoid | | | Clutch | | | Brake | | | I way Clutch | |
|---------------|-----|----------|----|-----|--------|----|-----|-------|----|-----|--------------|-----|
| | | S1 | S2 | ST | C1 | C2 | C3 | B1 | B2 | B3 | F1 | F2 |
| D | 4th | OFF | ON | OFF | OFF | ON | OFF | ON | ON | OFF | OFF | OFF |



D-4th

1. The input shaft turns clockwise.

The direct clutch (C2) is engaged. Connect the input shaft to the planetary carrier.

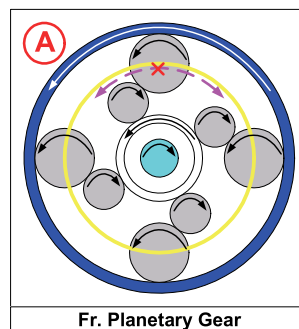
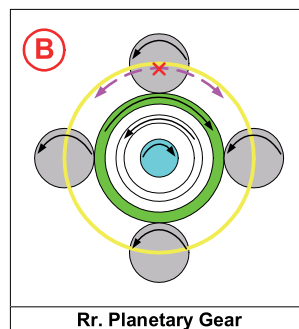
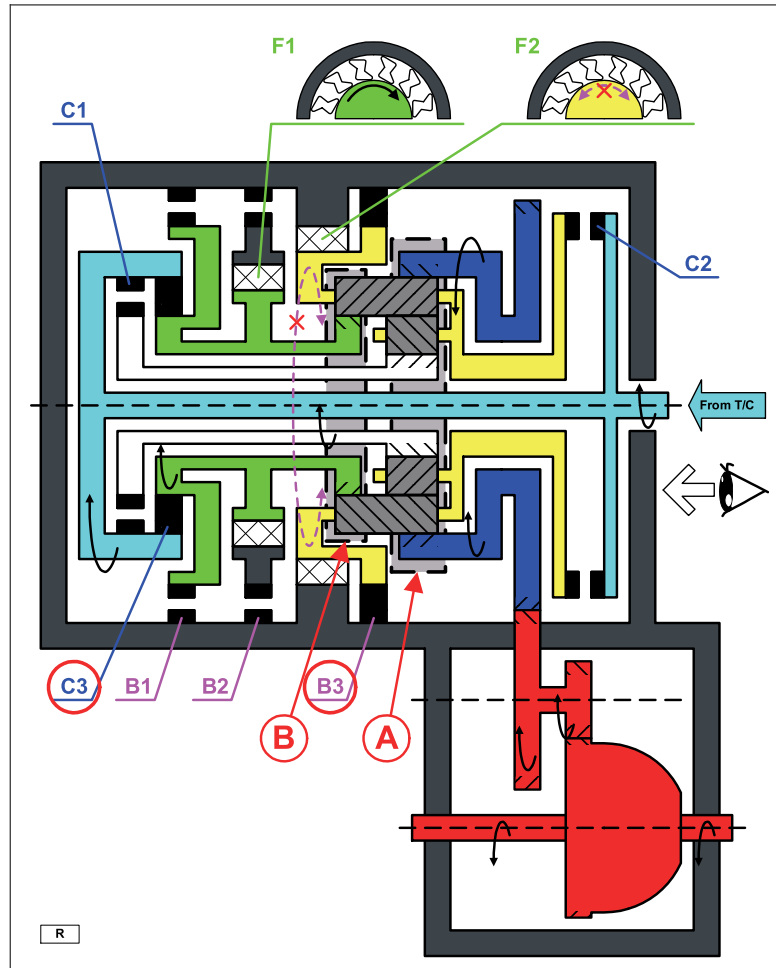
2. The planetary carrier turns clockwise.
3. The long planetary gear rotates clockwise.
4. The rear planetary sun gear will turn counterclockwise.
The overdrive and 2nd brake (B1) are engaged. The planetary sun gear's turning is locked.
5. The long planetary gear rotates clockwise while it makes revolution around.
6. The ring gear turns clockwise.
7. The counter shaft drive gear turns clockwise by the ring gear and counter shaft drive gear pair.
8. The counter shaft driven gear turns counterclockwise.
9. The differential gear drive bevel gear turns counterclockwise by the counter shaft driven gear and differential gear drive bevel gear pair.
10. The differential gear turns clockwise.

Engine Braking

Without the assistance of the 1 way clutch, the drive force is input into the input shaft pair. Therefore, the engine braking operates.

Reverse

| Gear Position | | Solenoid | | | Clutch | | | Brake | | | I way Clutch | |
|---------------|---------|----------|----|-----|--------|-----|----|-------|-----|----|--------------|-----|
| | | S1 | S2 | ST | C1 | C2 | C3 | B1 | B2 | B3 | F1 | F2 |
| R | <9 Km/h | ON | ON | OFF | OFF | OFF | ON | OFF | OFF | ON | OFF | OFF |



Reverse

1. The input shaft turns clockwise. The reverse clutch (C3) operates. Connect the input shaft to the rear planetary sun gear.
2. The long planetary gear rotates counterclockwise. The 1st and reverse brake (B3) operate. The planetary carrier's turning is locked.
3. The ring gear turns counterclockwise.
4. The counter shaft drive gear turns counterclockwise by the ring gear and counter shaft drive gear pair.
5. The counter shaft driven gear turns clockwise.
6. The differential gear drive bevel gear turns clockwise by the counter shaft driven gear and differential gear drive bevel gear pair.
7. The differential gear turns counterclockwise.

Engine Braking

Without the assistance of the 1 way clutch, the drive force is input into the input shaft pair. Therefore, the engine braking operates.

General Description

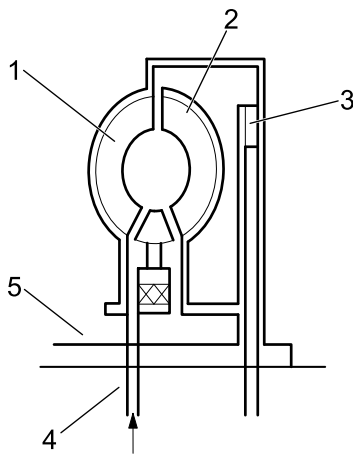
TCM controls the following functions:

- Shift Control
- Line Pressure Control
- Engine Torque Decrease
- Adaptive Regulation
- Hydraulic Torque Converter Lock-up Clutch Control
- Use of Driving Mode
- Uphill Mode 1, 2
- Downhill Mode
- Gear Position Display
- Driving Mode Display
- O/D Status Display
- Malfunction Condition
- Trouble Code Memory
- Emergency/Fail-safe Procedure Control

Shift and Lock Control

TCM performs the shifting time sequence regulations by using the relationship between vehicle speed and throttle position.

1. Pump Impeller
2. Turbine
3. Lock-up Clutch Mechanical Unit



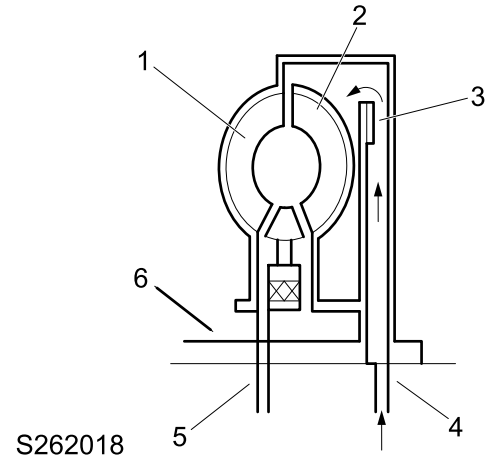
S262019

1. Pump Impeller
2. Turbine
3. Lock-up Clutch Mechanical Unit

There is some certain slide between the pump impeller and turbine in the hydraulic torque converter, which will decrease the fuel economy. Using the hydraulic torque converter lock-up device to eliminate this condition, and the lock-up devices are connected to the turbine. **TCM** will activate the lock-up clutch solenoid to operate the lock-up control valve, and guide the fluid flow to lock or release the hydraulic torque converter. The lock-up hydraulic pressure is applied to the lock-up supply line for the hydraulic torque converter,

Depending on these inputs, TCM sends electrical signals to shift solenoid (S1, S2) located in the valve body to control shift, and the lock-up clutch control solenoid (ST) to control the lock-up clutch.

Hydraulic Torque Converter Lock-up Clutch Control



S262018

4. Hydraulic Torque Converter Fluid Supply (Release)
5. Input Shaft

4. Hydraulic Torque Converter Fluid Supply (Lock-up)
5. Application Supply Unit
6. Input Shaft

forcing the lining of the lock-up device to stay on the pump impeller, and causing mechanical connection to eliminate the slide between the pump impeller and turbine. The release hydraulic pressure is applied to the hydraulic torque converter release supply line, forcing the lining to separate from the pump impeller, and thus returning to the hydraulic pressure connection between the pump impeller and turbine.

TCM monitors the relationship between the vehicle speed and throttle position, and determines when to lock the hydraulic torque converter.

Economy Mode

Normally, **TCM** defaults to the start economy mode. In this mode, the shift point and lock-up engagement point are the lower vehicle speed range, which decreases the engine speed to provide shift time sequence for economic driving, thus improving the fuel economy.

Even if in the economy mode, the automatic transmission will shift into some operation modes automatically when some certain conditions are met.

Sport Mode

In sport mode, **TCM** uses the shift map in which the engine speed at the high is higher than that in the economy mode. These strategies assist the acceleration and response of the vehicle.

Snow Mode

In the snow mode, the vehicle starts at 2nd. **TCM** will change the time sequence, assist the vehicle to be controlled under the slippery or icy conditions.

Uphill Mode 1, 2

This mode changes the shift mode to assist the drivability when driving on a steep. **TCM** activates the uphill mode by monitoring the engine torque value, throttle angle and engine speed. This mode selects the shift point at high speed according to the slope and avoids shifting frequently.

Downhill Mode

When the accelerator pedal is released completely, but the vehicle acceleration still increases. **TCM** judges that the vehicle is in the downhill mode in which the engine braking is operated by changing the shift point at high speed.

3-4 Range Cut Control at Low Temperature

When the temperature of the engine coolant is low, the control can inhibit up-shift from 3rd to 4th.

Coast Lock-up Control

If the lock-up function is on, the vehicle will maintain the current status until it falls below a certain speed even if the driver is performing the coast operation.

N-D, N-R Shift Control

The N-D, N-R shift control can improve the shift quality of N to D and N to R. The system controls the line pressure control solenoid valve (SLT), and use the optimal fluid pressure to control N-D, N-R shift quality.

Engine Torque Decrease

TCM improves the shift quality of N-D, N-R and among 1, 2, 3, 4 by sending engine torque decrease request to engine management system (EMS).

If the accelerator pedal is pressed quickly, this control will establish the upper limit of the engine torque during all the shifting to prevent the engine from knocking suddenly as the clutch shifts from 3rd, 4th, and this will improve the smooth shifting.

Line Pressure Control

The line pressure refers to the oil pressure for operation that is applied to the clutch and brake in the transmission. The line pressure control could guarantee smooth vehicle operation and shift. The line pressure control always responds to the current driving condition, adjusts and transmits the optimal operation pressure. For example, the line pressure in the normal operation conditions is lower than that in forced acceleration condition. **TCM** controls the line by activating the line pressure solenoid (SLT) in the valve body. **TCM** calculates the required line pressure depending on the engine speed, vehicle speed and throttle position. The high line pressure will cause the shift and gear engagement unsmooth. The low line pressure will make the shift time overlong, and cause the clutch and brake in the transmission to be burnt out soon.

Line Pressure Learning Control (Up-shift)

This control learns the oil pressure for operation that is applied to the clutch and brake in the transmission to decrease the shift shock when up-shifting.

Line Pressure Learning Control (3-4 Range)

This control learns the CI clutch timing by learning timing solenoid (ST), thus decreasing the shift shock of 3-4 range.

Line Pressure Learning Control (4-3 Range)

This control decreases the shift shock of 4-3 range by learning the line pressure to the CI clutch.

Line Pressure Learning Method:

1. The oil temperature is 50 °C-80 °C
2. Continuous throttle valve opening angle
3. Sufficient interval for shifting (approximately 3 seconds)
4. Shift 10 times repeatedly.

Fail-safe

When the automatic transmission is in the fail-safe mode, if the automatic transmission is currently at L, 2, D range, it shifts into 3rd and holds here; if at R, it holds in R.

Adaptive Regulation

Caution: When replacing the automatic transmission, TCM or upgrading the software, the original adapting data should be cleared and "adapting" is also needed again.

1. Engine Warm-up

By idling speed or driving on the road in city to increase the ATF temperature between 50 °C to 110 °C. Use the tester to confirm the ATF temperature.

Caution: Never increase the ATF temperature by the method of stall, and the adapting should be performed when the ATF temperature is between 50 °C and 110 °C

2. Up-shift Adaptive Learning

At D position, and perform 1-2, 2-3, 3-4 up-shift when it is at the following throttle valve opening angle, repeat the above 5 times.

| Adaptive Condition (1) - (5) | Throttle Valve Opening Angle | |
|---------------------------------|------------------------------|----------|
| | (1) 20% | (4) 80% |
| | (2) 40% | (5) 100% |
| | (3) 60% | |

3. 3-4 Shift Adaptive Learning

At D position, and perform 3-4 up-shift when it is at the following throttle valve opening, repeat the above 5 times.

| Adaptive Condition (1) - (5) | Throttle Valve Opening Angle | |
|---------------------------------|------------------------------|----------|
| | (1) 20% | (4) 80% |
| | (2) 40% | (5) 100% |
| | (3) 60% | |

4. 4-3 Shift Adaptive Learning

At D position and accelerate to 4th, perform 4-3 kick down at the following vehicle speed, repeat the above 5 times.

| Adaptive Condition (1) - (5) | Throttle Valve Opening Angle | |
|---------------------------------|------------------------------|-----------------|
| | (1) 20-55 km/h | (4) 90-125 km/h |
| | (2) 55-70 km/h | (5) >125 km/h |
| | (3) 70-90 km/h | |

5. Confirm the adaptive learning effectiveness

Confirm that the shift quality has been improved.

Service Procedures

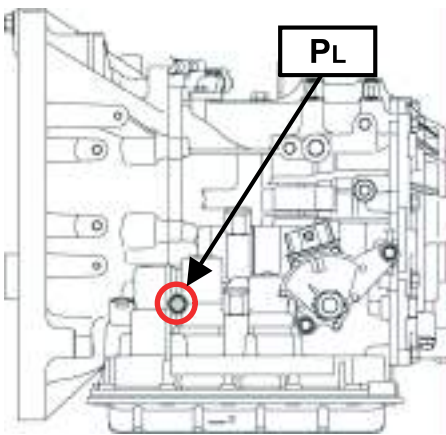
Hydraulic Pressure Test

Inspection

The hydraulic test inspects the operation in the automatic transmission by testing the idling, stall oil pressure in D, R.

Warning: DO NOT continue for more than 5 seconds, failure to do so may cause the ATF oil temperature overhigh. Make sure to keep an interval of more than 1 minute between each stall test.

1. Chock the four wheels of the vehicle with wooden block and pull the parking brake, lock the vehicle.
2. On the test hole PL of the automatic transmission, fit **T26001**.



Important: Make sure that no fluid leaks after the pressure gauge is fitted.

3. Press the brake pedal with your left foot, position the shift lever in "D" or "R", press the accelerator pedal with your right foot and measure the line pressure during idling and stalling.

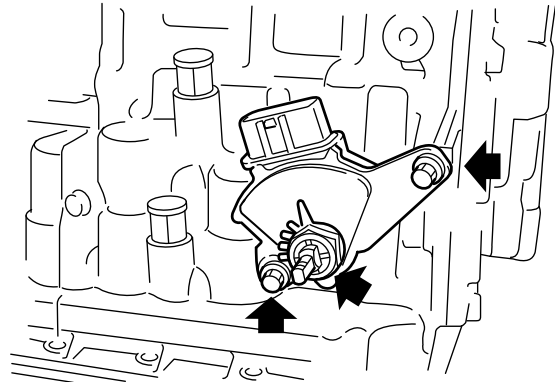
Line pressure:

| | |
|-------------|------------------------|
| Idling | |
| • D | 0.37-0.41 MPa |
| • R | 0.59-0.68 MPa |
| Stalling | |
| • D | 1.25-1.37 MPa |
| • R | 1.65-1.90 MPa |
| Stall Speed | Approximately 2400 rpm |

Neutral Start Switch

Removal

1. Make sure that the vehicle is in neutral.
2. Raise the vehicle on a lift.
3. Loosen the operating rocker arm on the neutral start switch, and move the rocker arm and cable aside.
4. Disconnect the connector from the neutral start switch.



5. Pry out the lock washer.
6. Remove the lock nut, lock washer from the neutral start switch.
7. Remove the 2 bolts securing the neutral start switch to the automatic transmission and remove the switch.

Refit

1. Fit the neutral start switch and bolts to the transmission, do not tighten fully.
2. Fit the lock washer and lock nut and tighten to **5.9-7.8 Nm**.
3. Connect the connector to the switch.
4. Adjust the neutral start switch.

Neutral Start Switch - Inspection and Adjustment

5. Tighten the neutral start switch set bolt to **4.3-6.5 Nm**
6. Lock the lock washer.
7. Position the operating rocker arm on the neutral start switch, and make sure that it is secured properly. Fit and tighten the nut to **14-20 Nm**.
8. Check that the engine can start at P and N, and cannot start when shifting to other gear positions.

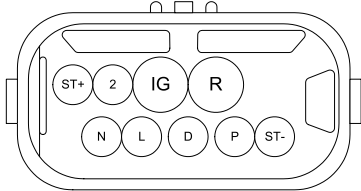
Neutral Start Switch - Inspection and Adjustment

Inspection

1. Remove the neutral start switch.

Neutral Start Switch Removal

2. According to the polarity and the connector end view shown in the illustration, test if there is continuity in each gear position.



| RANGE | STARTER CIRCUIT | | POSITION CIRCUIT | | | | | | | |
|----------|-----------------|-----|------------------|---|---|---|---|---|---|---|
| | ST+ | ST- | IG | P | R | N | D | 2 | L | |
| P | ○ | ○ | ○ | ○ | | | | | | |
| R | | | ○ | | ○ | | | | | |
| N | ○ | ○ | ○ | | | ○ | | | | |
| D | | | ○ | | | | ○ | | | |
| 2 | | | ○ | | | | | ○ | | |
| L | | | ○ | | | | | | ○ | |
| POLARITY | + | - | + | - | - | - | - | - | - | - |

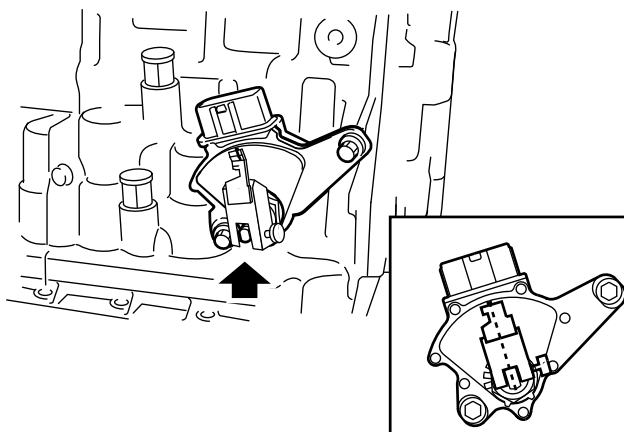
Caution: The current applied cannot more than 0.1 A, failure to do so may cause the contact points in the neutral start switch fail.

3. If the wrong gear range is displayed during the test, replace the neutral start switch.
4. After the test, fit the neutral start switch.

Neutral Start Switch Refit

Adjustment

1. Make sure that the shift lever is shifted into N.
2. Loosen the operating rocker arm on the neutral start switch, and move the rocker arm and cable aside.
3. Fit **TPT00001** to the manual valve lever, and check if the line on the **TPT00001** is aligned with the reference line on the neutral start switch.



4. Align the line on the **TPT00001** with the reference line on the neutral start switch.

5. Position the operating rocker arm on the neutral start switch, and make sure that it is secured properly. Fit and tighten the nut to **14-20 Nm**
6. Check that the engine can start at P and N, and cannot start when shifting to other gear positions.

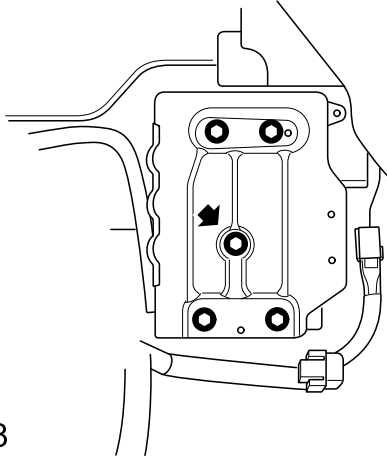
Automatic Transmission Assembly

Removal

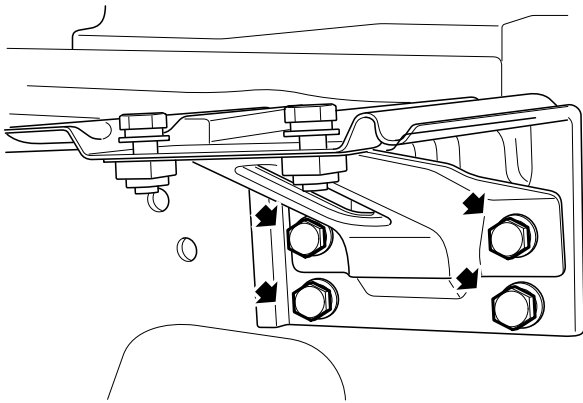
1. Remove the battery box.

Battery Box Removal

2. Remove the bolts securing the battery tray, and remove the battery support.



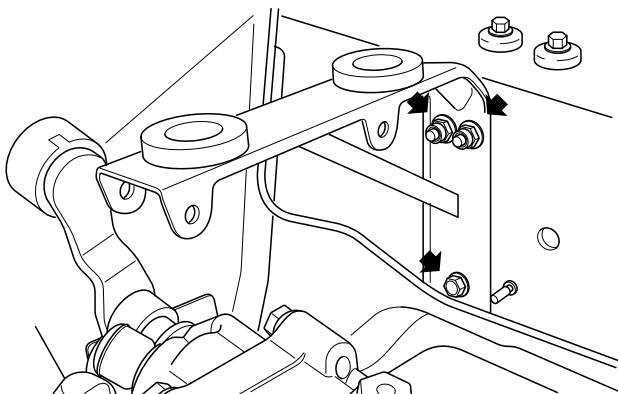
S111N008



S111N009

3. Remove the air cleaner assembly.

Air Cleaner Assembly Removal



S111N007

4. Remove the bolts and nuts securing the air cleaner bracket and move the bracket away.
5. Drain the automatic transmission fluid.

Automatic Transmission Fluid - Drain

6. Remove the drive shaft assembly.

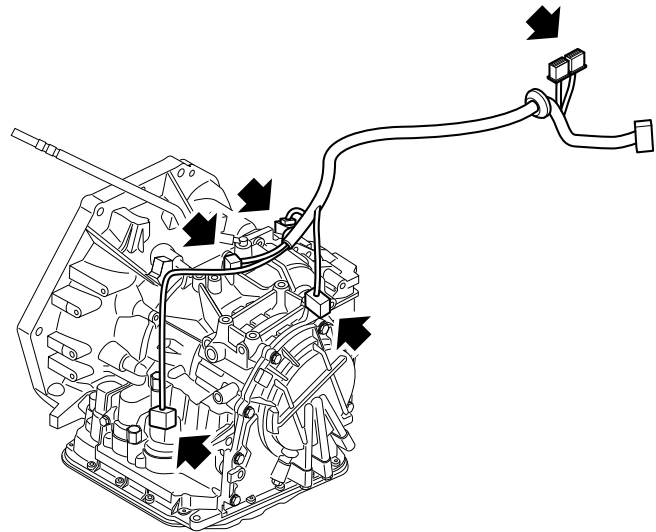
Drive Shaft Assembly RH Removal

Drive Shaft Assembly LH Removal

7. Remove the oil cooler inlet and return tube.

Automatic Transmission Case Oil Cooling Pipe Replacement

8. Loosen the cable from the cable bracket and disconnect the connection between cable and neutral start switch.
9. Use a hanger to support the engine.
10. Disconnect the input speed sensor connector.
11. Disconnect the output speed sensor connector.
12. Disconnect the neutral start switch connector.
13. Disconnect the valve body wire harness connector.



14. Loosen the 3 snap fits securing the automatic transmission wire to the automatic transmission.

15. Loosen the 2 snap fits securing the positive battery cable to the bracket.

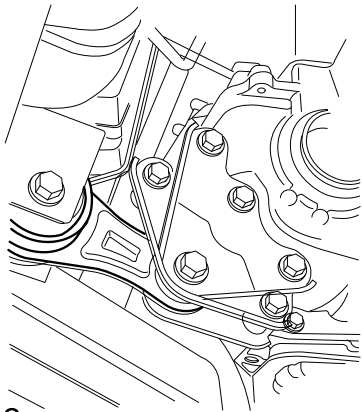
16. Support the automatic transmission with a jack.

17. Remove the starter motor.

Starter Motor Removal

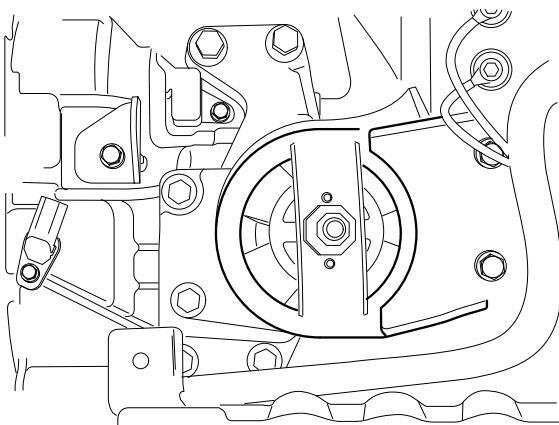
18. Remove the 7 service bolts connecting the engine and automatic transmission.

19. Remove the service bolts connecting the lower tied rod and lower tied rod bracket and loosen the service bolts and nuts between the lower tied rod and the front sub frame.



S111N012

- Remove the nuts from the automatic transmission mounting bracket to the mounting.



S111N013

- Lower the jack slowly and carefully, and remove the automatic transmission assembly.
- Loosen the 4 set bolts and remove the automatic transmission mounting bracket.

Refit

- Clean the mating surface of the engine and automatic transmission.
- Clean the location pin and the pin hole of the transmission.
- Use a hanger to support the engine.
- Fit the automatic transmission mounting bracket to the automatic transmission and tighten the set bolt to **50-60 Nm**.
- Keep the automatic transmission securing on a jack, and then lift up the jack, position it carefully on the vehicle.
- Align the front end of the hydraulic torque converter with the hole of engine crankshaft, and also the location pin of the engine with the location pin hole of automatic transmission, make the transmission and engine snug.
- Fit the 7 bolts connecting the engine and automatic transmission and respectively tighten them to **75-90 Nm**.

- Fit the union nut connecting the mounting to mounting bracket and tighten to **90-110 Nm**
- Fit the service bolts connecting the lower tied rod and lower tied rod bracket and tighten to **90-110 Nm**.
- Tighten the service bolts and nuts connecting the lower tied rod and the front sub frame to **70-90 Nm**.
- Fit the 6 bolts connecting the hydraulic torque converter and drive plate through the service hole. To ensure the accurate position, temporarily tighten the 6 bolts and finally tighten them to **25-35 Nm**.
- Fit the dust cover of the service hole.
- Fit the starter motor.

Starter Motor Refit

- Secure the 3 snap fits securing the automatic transmission wire to the automatic transmission.
- Secure the 2 snap fits securing the positive battery cable to the bracket.
- Connect the input speed sensor connector.
- Connect the output speed sensor connector.
- Connect the neutral start switch connector.
- Connect the valve body wire harness connector.
- Secure the cable to the bracket and connect the cable and neutral start switch.
- Fit the oil cooler inlet and return tube.

Automatic Transmission Case Oil Cooling Pipe Refit

- Fit the drive shaft assembly.

Drive Shaft Assembly RH Refit**Drive Shaft Assembly LH Refit**

- Add the automatic transmission fluid.

Automatic Transmission Fluid - Refill

- Fit the air cleaner assembly.

Air Cleaner Assembly Refit

- Fit and secure the air cleaner bracket and tighten the bolt and nut to **5-7 Nm**.
- Fit the battery box.

Battery Box Refit

- Fit the battery tray and tighten the bolt to **40-50 Nm**.

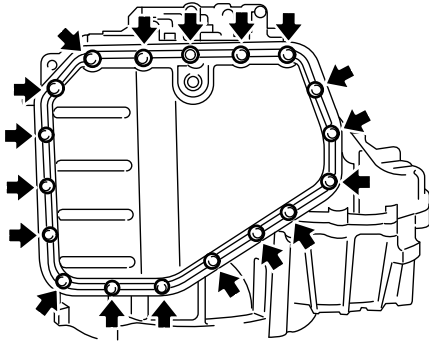
Automatic Transmission Fluid - Drain and Refill

Drain

Warning: Take extra care when draining the transmission fluid, as the fluid may be very hot.

Important: The transmission fluid can be drained only when the transmission is at normal operating temperature.

1. Place a proper container under the transmission to collect **ATF**.
2. Clean the area around the drain plug.
3. Remove the drain plug and dispose of the gasket seal.



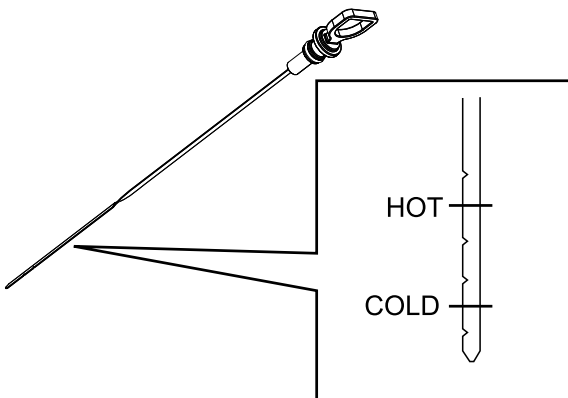
4. Drain the fluid.

Refill

1. Clean the drain plug and fit new gasket seal.
2. Fit the drain plug and tighten it to **14.7-19.6 Nm**.
3. Remove the intake pipe assembly.

Intake Pipe Assembly Removal

4. Clean the area around the filler/dipstick.
5. Pull the dipstick out.



6. Check the O-ring, and replace it if necessary.
7. Add the filler with proper amount of transmission fluid.

Automatic Transmission Fluid - Add

8. Clean the area around the filler and insert the dipstick.
9. Fit the intake pipe assembly.

Intake Pipe Assembly Refit

10. Start the engine, move the shift lever through all the

gear positions from P and stay for 2-3 seconds for each, and then return to P.

11. Remove the dipstick and check if the oil level is in the range of "HOT".
12. Refill **ATF** to the range of "HOT" on the dipstick.
13. Fit the O-ring to the dipstick, and insert the dipstick.
14. Fit the intake pipe assembly.

Intake Pipe Assembly Refit

Automatic Transmission Fluid - Add**Inspection and Add**

Important Precaution: When there is a malfunction in the internal of automatic transmission, along with the deterioration of ATF (metal particles, powders of friction lining, smell of burning, white emulsion), so detecting the ATF is much more important.

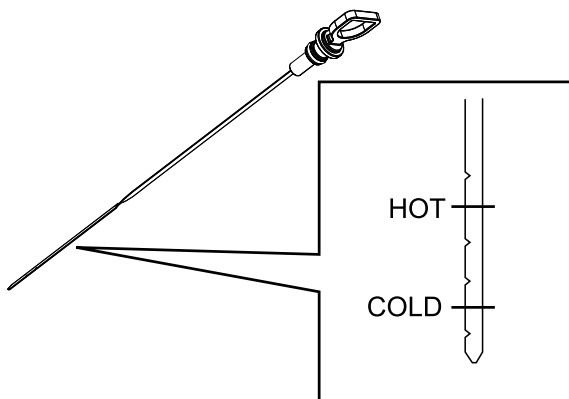
Important Precaution: Oil level too low: Air enters into the oil pump, cause the oil pressure too low and transmission malfunctioning. Oil level too high: A large number of foam is produced due to the stir of gear set, and meanwhile spills out from breather tube.

Important Precaution: Normal ATF: Red and proper stickiness. Abnormal ATF: Water (white emulsion) or different ATF blending cause "shift shock", "rough operation" and make the performance poor.

1. Make sure that the vehicle is on a level surface.
2. Confirm if the oil temperature is normal (70°C-80°C).

Caution: The ATF level when the vehicle is cold is different from the level when in warm up, and the fluid level should be checked when the vehicle is warm up.

3. The engine is idling, move the shift lever to each gear in order from P, and return to P.
4. Clean the area around the filler/dipstick.
5. Pull the dipstick out.



6. Check the O-ring, and replace it if necessary.
7. Wipe the dipstick dry and check if the ATF oil level is in "HOT" range.

Caution: Follow the lower value when the oil level be measured before and after is different.

Caution: If the ATF oil level is low, there may be leakage in some areas. So, check related areas thoroughly.

8. Add the filler with oil to the "HOT" range on the dipstick.

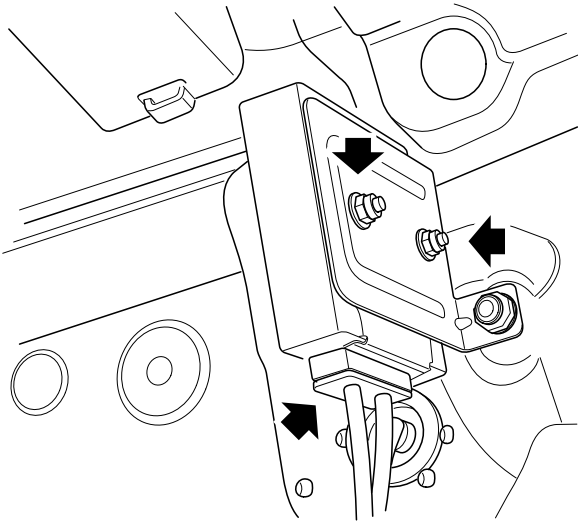
Caution: Use the specified ATFJWS-3309(T-IV), make sure that slide control function is proper.

9. Wipe the dipstick dry and check the ATF level.
10. Fit the O-ring to the dipstick, and insert the dipstick.

Transmission Control Module (TCM)**Removal**

Warning: For the TCM fitted in the vehicle, it is not allowed to fit it to the other vehicle after it removed. The unique information corresponding to the different vehicles has been recorded in corresponding TCM, program recognition fault will occur if the TCM is replaced to another vehicle, and result in shift shock problem,

1. Disconnect the battery negative terminal.
2. Remove the driver side sealed panel.
3. Disconnect 2 connectors of **TCM** and move the wire harness aside.



4. Remove the 2 nuts securing **TCM** to the bracket.
5. Remove the **TCM** from the vehicle.

Refit

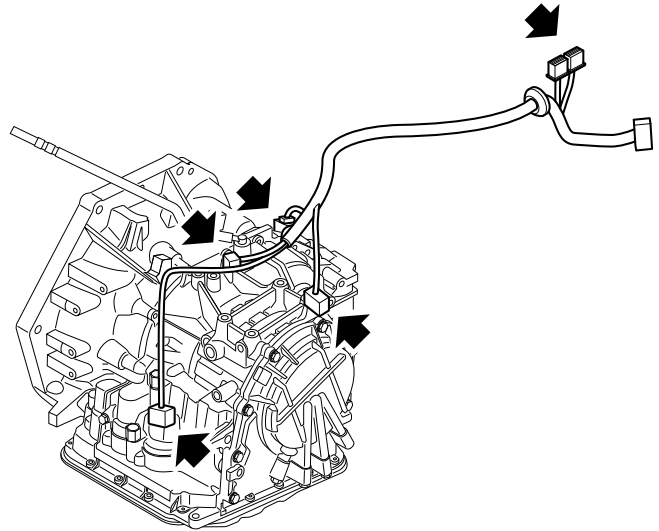
1. Position the **TCM** on the bracket, and fit the nuts to **TCM** and tighten them to **4 Nm**.
2. Position the wire harness and connect the connectors to **TCM**.
3. Fit the driver side sealed panel.
4. Connect the battery negative terminal.

Automatic Transmission Wire**Removal**

1. Remove the air cleaner assembly.

 **Air Cleaner Assembly Removal**

2. Disconnect the input speed sensor connector.
3. Disconnect the output speed sensor connector.
4. Disconnect the neutral start switch connector.
5. Disconnect the transmission wire connector.
6. Disconnect the **TCM** connector.



7. Disconnect the instrument panel wire connector.
8. Loosen the 3 snap fits securing the wire harness to the transmission and move the wire harness away.

Refit

1. Position the wire harness and secure with snap fits.
2. Connect the instrument panel wire connector.
3. Connect the **TCM** connector.
4. Connect the transmission wire connector.
5. Connect the neutral start switch connector.
6. Connect the input speed sensor connector.
7. Connect the output speed sensor connector.
8. Fit the air cleaner assembly.

 **Air Cleaner Assembly Refit**

Input Speed Sensor**Removal**

Warning: The work can be started 90 seconds after the ignition switch is turned off, and the battery earth lead is disconnected.

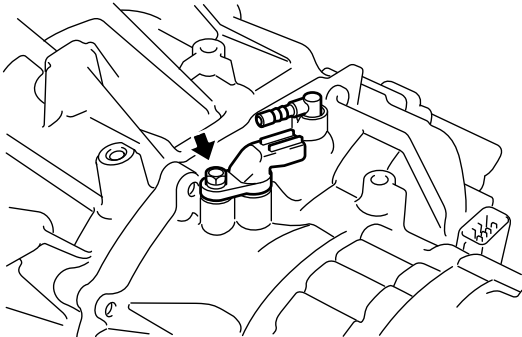
Warning: Pay attention to the position of the disconnected earth lead, and make sure to avoid a contact with the battery negative again.

1. Remove the air cleaner assembly.

 **Air Cleaner Assembly Removal**

2. Remove 1 bolt securing the input speed sensor to the transmission, and move the input speed sensor away.

Caution: Be careful not to damage the input speed sensor and transaxle housing.

**Refit**

1. Fit the new O-ring applied with automatic transmission fluid to the input speed sensor.
2. Fit the input speed sensor to the transmission and tighten the bolt to **3.9-6.9 Nm**.

Note: Always use a new sealing bolt.

3. Fit the air cleaner assembly.

 **Air Cleaner Assembly Refit**
Output Speed Sensor**Removal**

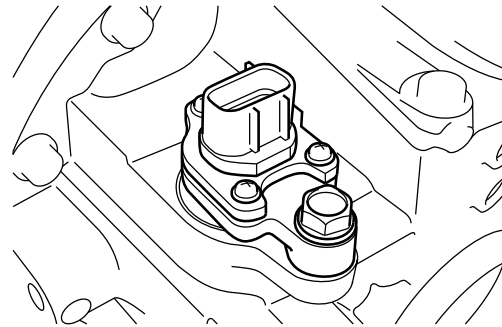
Warning: The work can be started 90 seconds after the ignition switch is turned off, and the battery earth lead is disconnected.

Warning: Pay attention to the position of the disconnected earth lead, and make sure to avoid a contact with the battery negative again.

1. Remove the air cleaner assembly.

 **Air Cleaner Assembly Removal**

2. Remove 1 bolt securing the output speed sensor to the transmission, and move the output speed sensor away.



Caution: Be careful not to damage the output speed sensor and transaxle housing.

Refit

1. Fit the new O-ring applied with automatic transmission fluid to the output speed sensor.
2. Fit the output speed sensor to the transmission and tighten the bolt to **11.7-14.3 Nm**.

Note: Always use a new sealing bolt.

3. Fit the air cleaner assembly.

 **Air Cleaner Assembly Refit**

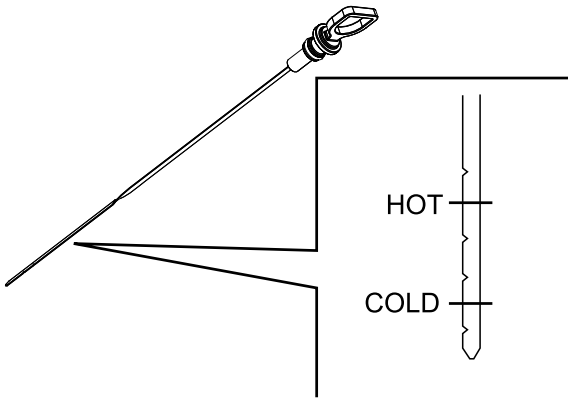
Filler Pipe and Oil Dipstick

Removal

1. Remove the intake pipe assembly.

 **Intake Pipe Assembly Removal**

2. Pull the dipstick out.



3. Disconnect the automatic transmission vent tube from the filler pipe.
4. Loosen the bracket set bolt of the filler pipe assembly.
5. Pull the filler pipe assembly out from the refill hole on the automatic transmission case and dispose of the O-ring.

Refit

1. Insert the filler pipe assembly into the refill hole on the automatic transmission case.
2. Secure the filler pipe assembly bracket on the transmission case and tighten the set bolt to **7-9 Nm**.
3. Insert the dipstick into the transmission filler.
4. Insert the automatic transmission vent tube into the breather tube of filler pipe assembly.
5. Fit the intake pipe assembly.

 **Intake Pipe Assembly Refit**

Automatic Transmission Case End Oil Seal

Removal

1. Drain the automatic transmission fluid.

 **Automatic Transmission Fluid Drain**

2. Remove the drive shaft assembly LH.

 **Drive Shaft Assembly LH Removal**

3. Insert a flat-head screwdriver between the differential housing and oil seal to remove the oil seal easily.

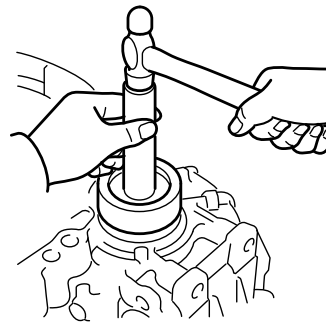
Caution: *Tape the flat-head screwdriver tip before use. Be careful not to damage the transaxle housing and differential housing.*

4. Using a flat-head screwdriver, pry out the oil seal.

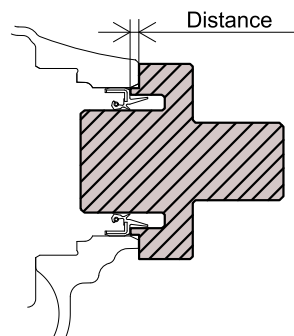
Refit

1. Using **TPT00002** and a hammer, fit the new oil seal to the transaxle housing.

Caution: *Be careful not to damage the oil seal.*



2. Specification: Distance, 3.8-4.8 mm (from the bottom of automatic transmission case).



3. Fit the drive shaft assembly LH.

 **Drive Shaft Assembly LH Refit**

4. Refill the automatic transmission fluid and check the fluid level.

 **Automatic Transmission Fluid Refill**

Converter Housing End Oil Seal

Removal

1. Drain the automatic transmission fluid.

Automatic Transmission Fluid Drain

2. Remove the drive shaft assembly RH.

Drive Shaft Assembly RH Removal

3. Insert a flat-head screwdriver between the differential housing and oil seal to remove the oil seal easily.

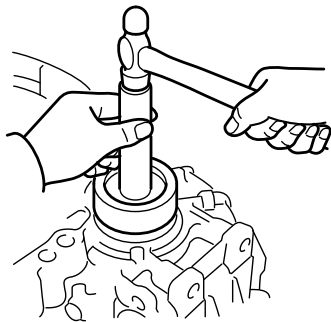
Caution: Tape the flat-head screwdriver tip before use. Be careful not to damage the transaxle housing and differential housing.

4. Using a flat-head screwdriver, pry out the oil seal.

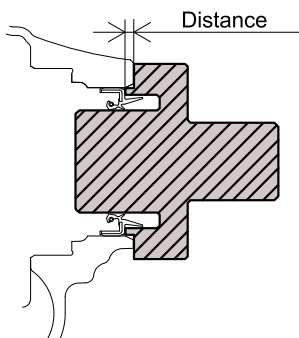
Refit

1. Using **TPT00002** and a hammer, fit the new oil seal to the transaxle housing.

Caution: Be careful not to damage the oil seal.



2. Specification: Distance, 2.6-3.6 mm (from the bottom of converter housing end).



3. Fit the drive shaft assembly RH.

Drive Shaft Assembly RH Refit

4. Refill the automatic transmission fluid and check the fluid level.

Automatic Transmission Fluid Refill

Hydraulic Torque Converter

Removal

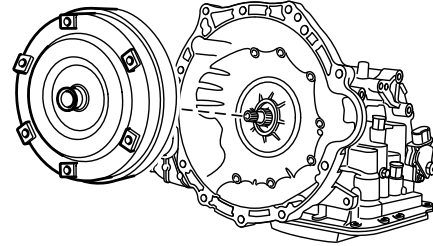
1. Drain the automatic transmission fluid.

Automatic Transmission Fluid Drain

2. Remove the automatic transmission.

Automatic Transmission Removal

3. Remove the hydraulic torque converter.



Caution: Important: Be careful not to damage the oil seal or drop the torque converter assembly.

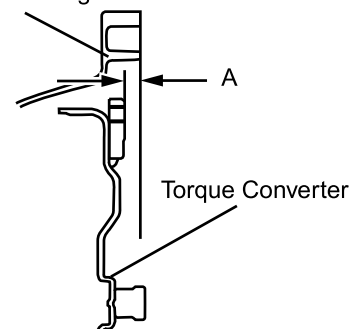
Refit

1. Fit the torque converter to the automatic transmission.

Caution: Important: Be careful not to damage the oil seal or drop the torque converter assembly.

2. Check if the torque converter is properly fitted in place.
3. Specification: A = 17.3 mm (from the end of transaxle housing).

Transaxle Housing



4. Fit the transmission assembly.

Transmission Assembly Refit

5. Fit the drain plug and tighten it to **14.7-19.6 Nm**.
6. Refill **ATF** and check the fluid level.

Automatic Transmission Fluid Refill

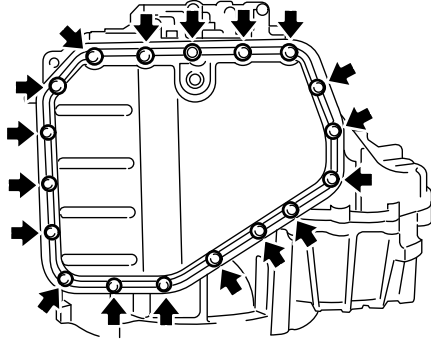
Valve Body Cover

Removal

1. Raise the vehicle on a lift.
2. Drain the automatic transmission fluid.

Automatic Transmission Fluid Drain

3. Remove 18 bolts securing the valve body cover, and remove the valve body cover and dispose of its washer.



Caution: Be careful not to damage the valve body cover and transaxle housing.

Refit

1. Remove the packing material on the transaxle contact surface and wipe off the oil on the contact surface.

Caution: Be careful to ensure that the contact surface is free from oil.

2. Use a new washer on the new valve body cover.
3. Fit the valve body cover to the transaxle housing.
4. Fit 18 new bolts and tighten them to **6-7.9 Nm**.

Note: Always use a new sealing bolt.

5. Fit the drain plug and tighten it to **14.7-19.6 Nm**.
6. Refill **ATF** and check the fluid level.

Automatic Transmission Fluid Refill

Oil Pump Oil Seal

Removal

1. Remove the hydraulic torque converter.

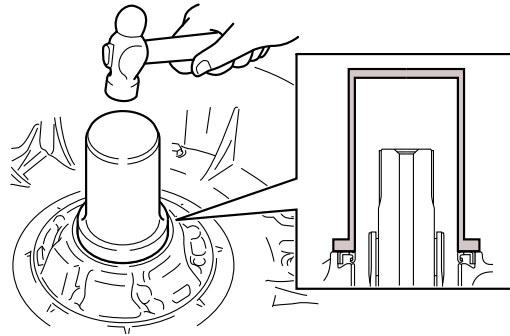
Hydraulic Torque Converter Removal

2. Remove the oil seal at the oil pump with a tool.

Caution: Be careful not to damage the oil seal and the input shaft.

Refit

1. Using **TPT00004** and a hammer, fit the new oil seal to oil pump.



Caution: Be careful not to damage the oil seal and the input shaft.

2. Specification: **-0.15-0.15 mm** (from the end of oil pump body).
3. Apply the grease on the lip of the oil seal.
4. Fit the torque converter to the automatic transmission.

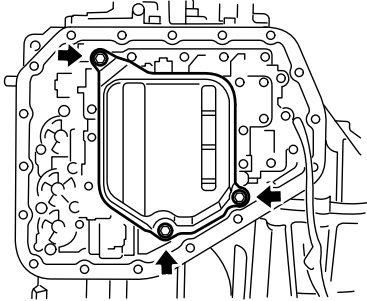
Hydraulic Torque Converter Refit

Strainer**Removal**

1. Remove the automatic transmission valve body cover.

 **Valve Body Cover Removal**

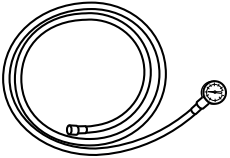
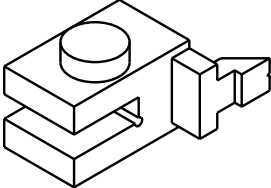
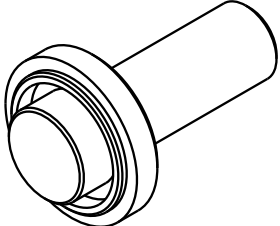
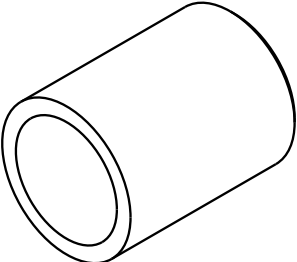
2. Remove the 3 bolts securing the strainer, and take off the strainer.

**Refit**

1. Fit the strainer and tighten 3 set bolts to **7.8-11.8 Nm**.
2. Fit the automatic transmission valve body cover.

 **Valve Body Cover Refit**

Special Tools

| Tool Number | Description | Picture |
|-------------|---|---|
| T26001 | Automatic Transmission Case Pressure Test |  <p>T26001</p> |
| TPT00001 | Neutral Start Switch Position Adjustment Tool |  <p>TPT00001</p> |
| TPT00002 | Drive Shaft Oil Seal Replacer (RH) |  <p>TPT00002</p> |
| TPT00004 | Housing Oil Seal Replacer |  <p>TPT00004</p> |

Transmission-MT**Specifications****Torque**

| Description | Value |
|---|------------|
| Bolt - Select Rocker Arm Assembly to Handling Base | 22-30 Nm |
| Drain Plug | 30-40 Nm |
| Refill Plug | 30-40 Nm |
| Back-up Light Switch | 32-44 Nm |
| Bolt - Rear Housing Deck Board to Rear Housing | 10-14 Nm |
| Bolt - Drive Shaft Front Bearing Cover Plate to Front Housing | 22-30 Nm |
| Bolt - Main Speed Reduction Driven Gear to Differential Housing | 140-170 Nm |
| Bolt - Front Housing to Rear Housing | 30-40 Nm |
| Bolt - Handling Base to Rear Housing | 22-30 Nm |
| Bolt - Gear Shift Bracket to Front Housing | 22-30 Nm |
| Bolt - Rear Housing to Reverse Shaft | 32-44 Nm |
| Bolt - Reverse Lock Stopper Plate to Handling Base | 18-26 Nm |
| Location Pin - Rear Housing to Interlock Ring | 30-40 Nm |
| Bolt - Oil Cylinder Holding Bracket to Rear Housing | 22-30 Nm |
| Self-locking Pin Assembly | 32-44 Nm |
| Bolt - Guide Sleeve to Front Housing | 10-14 Nm |

Transmission

Transmission-MT

| Description | Value |
|--|----------|
| Bolt - Release Fork to Release Rocker Arm Assembly | 30–40 Nm |

Parameter

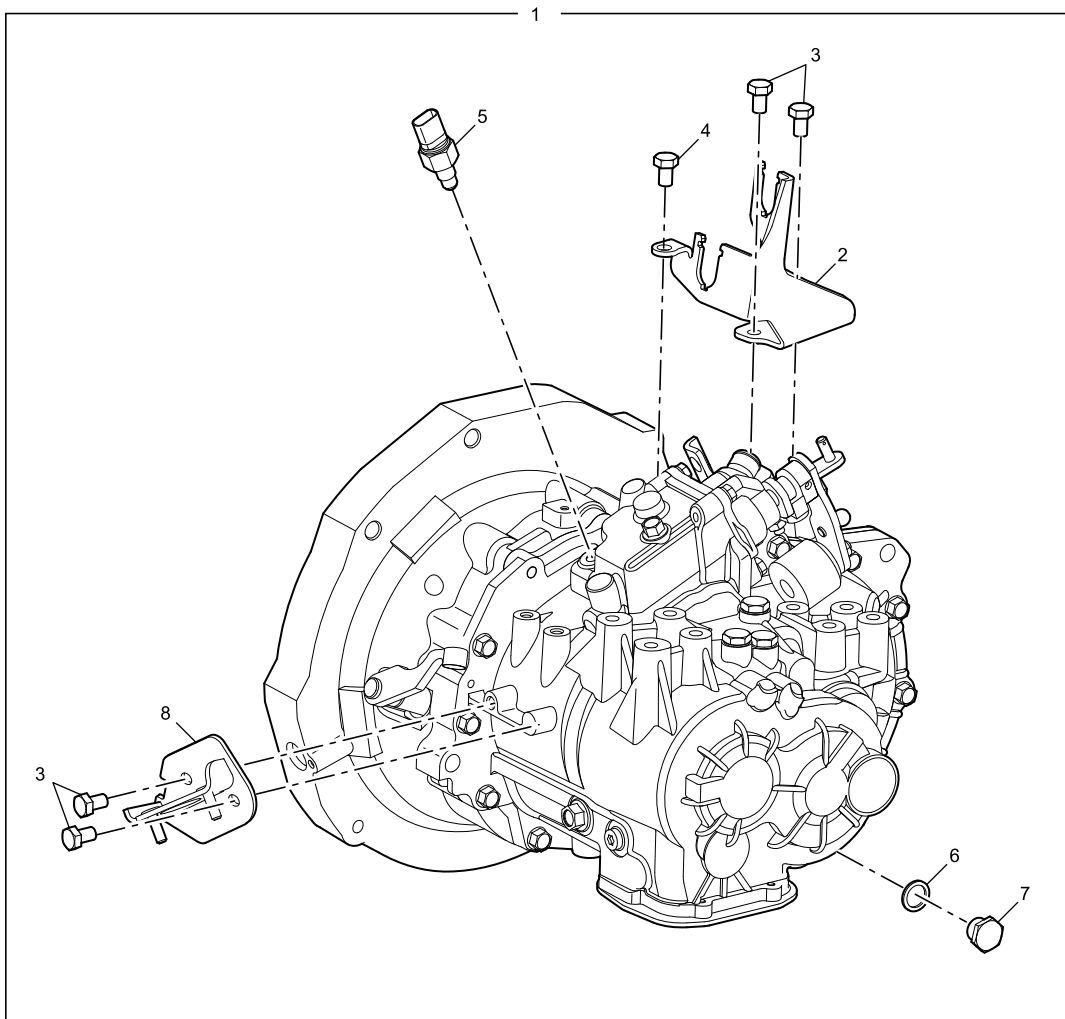
Manual Transmission

| | |
|--|--|
| Model | 5-speed Manual Transmission SH78ZB (1.5 VCT) |
| Speed Ratio: | |
| · 1st gear | 3.583 |
| · 2nd gear | 2.105 |
| · 3rd gear | 1.379 |
| · 4th gear | 1.030 |
| · 5th gear | 0.820 |
| · Reverse gear | 3.363 |
| · Main speed reduction | 4.389 |
| Transmission Centre Distance | 78 mm |
| Maximum Input Torque | 135 Nm |
| Maximum Input Speed | 7000 r/min |
| Weight (without oil) | 44.8 kg |
| Lubricant | MTF94 |
| Standard Oil Capacity: | |
| · Drain and Refill | 2.0 L |
| · Dry Fill | 2.2 L |
| Maximum Transmission Contour Size (Length x Width x Height) | 399 mm x 504 mm x 392 mm |

Description and Operation

System Component Layout

Transmission Assembly and Accessory



1. 1.5 L Manual Transmission Assembly

2. Gear Shift Bracket

3. Screw - Gear Shift and Cylinder Bracket

4. Screw - Gear Shift Bracket

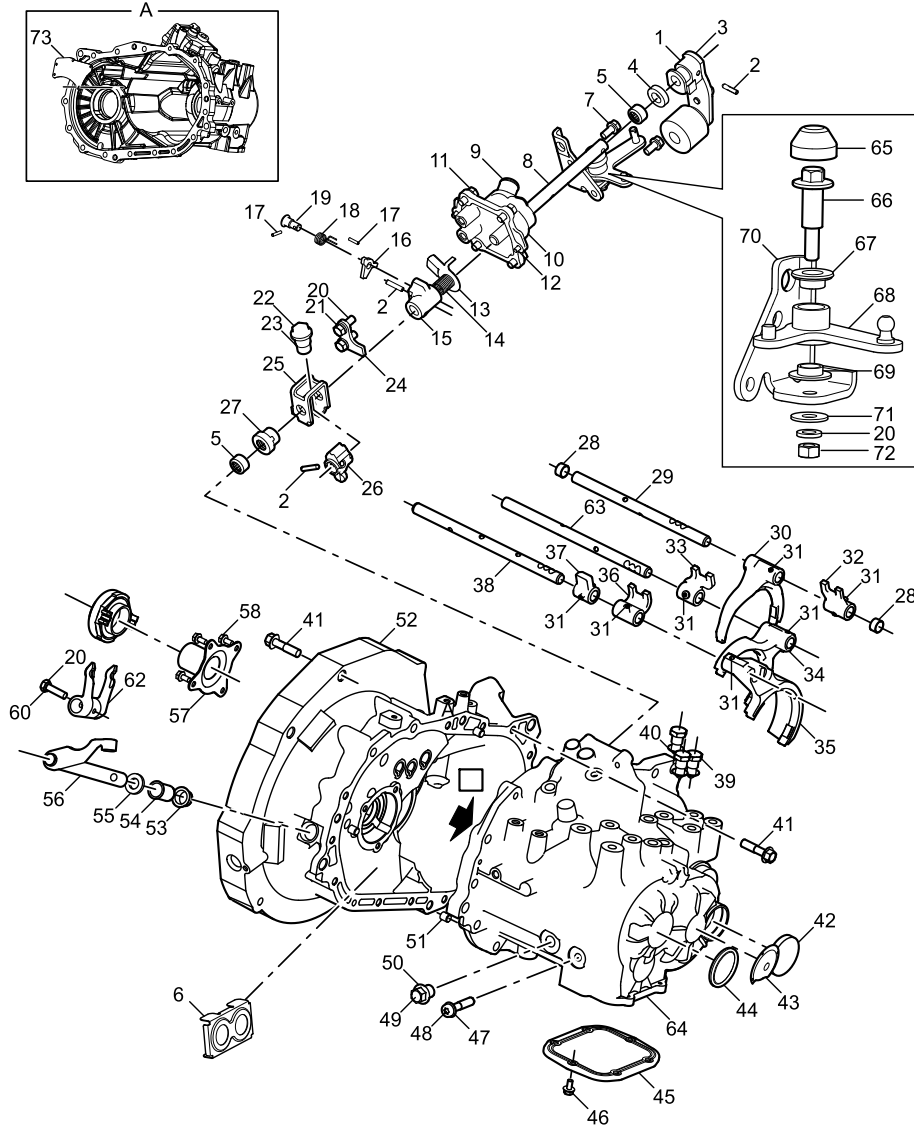
5. Back-up Light Switch Assembly

6. Aluminum Washer

7. Drain Plug

8. Release Cylinder Bracket

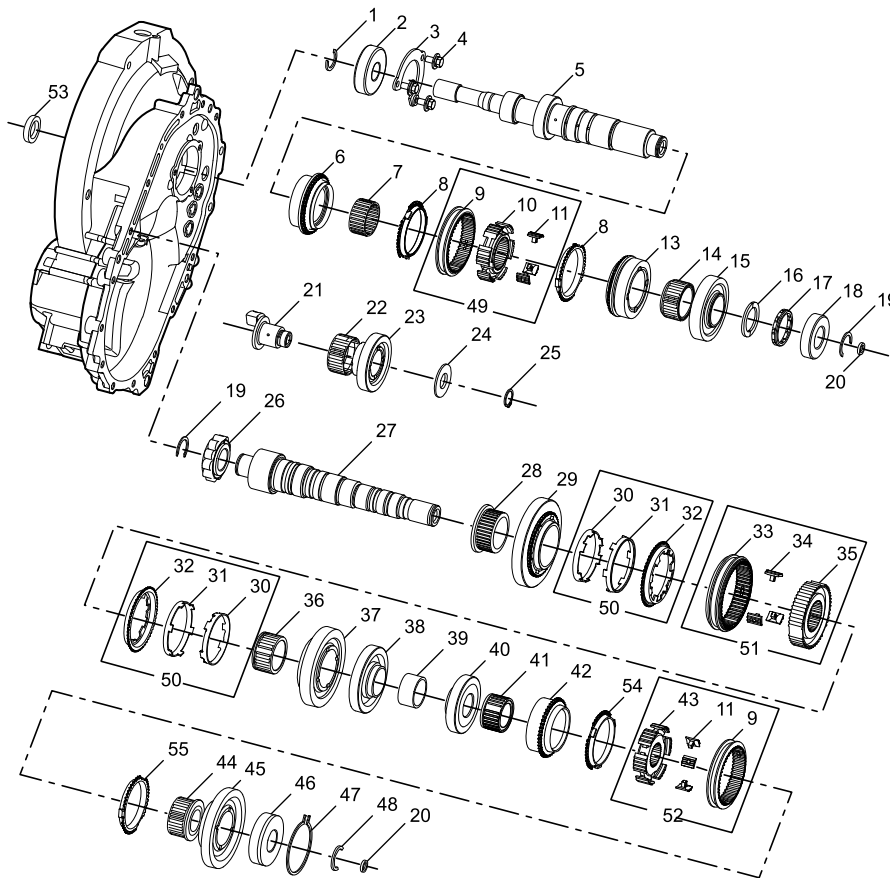
Transmission Control and Case



- | | |
|--|---|
| 1. Shift Rocker Arm Assembly | 17. Spring Pin $\text{Ø}3 \times 16$ |
| 2. Combination Elastic Cylindrical Pin | 18. Reverse Lock Torsional Spring |
| 3. Nylon Block | 19. Reverse Lock Shaft |
| 4. Gear Shift Shaft Oil Seal | 20. Washer |
| 5. Gear Shift Shaft Linear Bearing | 21. Bolt - Connect Reverse Lock Retainer Plate to Handling Base |
| 6. Magnetic Steel Assembly | 22. Location Pin |
| 7. Bolt - Connect Selector Support to Handling Base | 23. Aluminum Washer |
| 8. Gear Shift Shaft | 24. Reverse Lock Retainer Plate |
| 9. Breather Plug | 25. Interlock Ring |
| 10. Handling Base | 26. Gear Shift Arm Guide |
| 11. Bolt - Connect Handling Base to Rear Housing | 27. 5th/Reverse Return Spring Assembly |
| 12. Handling Base Location Pin - Connect Handling Base to Rear Housing | 28. 1st/2nd Shift Fork Shaft Bushing |
| 13. 1st/2nd Return Spring Retainer | 29. 1st/2nd Shift Fork Shaft |
| 14. 1st/2nd Return Spring | 30. 1st/2nd Shift Fork |
| 15. Reverse Safety Stand | 31. Spring Pin $\text{Ø}5 \times 22$ |
| 16. Reverse Lock Block | 32. 1st/2nd Shift Selector |

-
- | | |
|---|------------------------------------|
| 33. 3rd/4th Shift Selector | 54. Release Fork Bushing |
| 34. 3rd/4th Shift Fork | 55. Release Fork Boot |
| 35. 5th/Reverse Shift Fork | 56. Release Rocker Arm Assembly |
| 36. 5th/Reverse Shift Fork | 57. Guide Sleeve |
| 37. Back-up Light Signal Block | 58. Guide Sleeve Bolt |
| 38. 5th/Reverse Shift Fork Shaft | 59. Release Bearing Assembly |
| 39. Self-locking Pin Assembly | 60. Release Fork Bolt |
| 40. Aluminum Washer | 61. |
| 41. Housing Service Bolt | 62. Release Fork |
| 42. Cover | 63. 3rd/4th Shift Fork Shaft |
| 43. Driven Shaft Guide Nozzle | 64. Rear Housing |
| 44. Drive Shaft Guide Nozzle | 65. Dust Cover - Select Rocker Arm |
| 45. Rear Housing Deck Board | 66. Centre Pin - Select Rocker Arm |
| 46. Bolt - Rear Housing Deck Board | 67. Nylon Washer (Flange) |
| 47. Bolt - Reverse Idler Gear Shaft | 68. Select Rocker Arm |
| 48. Aluminum Washer | 69. Nylon Washer |
| 49. Oil Filler Plug | 70. Select Rocker Arm Bracket |
| 50. Aluminum Washer - Oil Filler Plug | 71. Plate Washer |
| 51. Location Pin - Front and Rear Housing | 72. Nut - Select Rocker Arm |
| 52. Front Housing | 73. Oil Deflector |
| 53. Release Fork Bushing | |

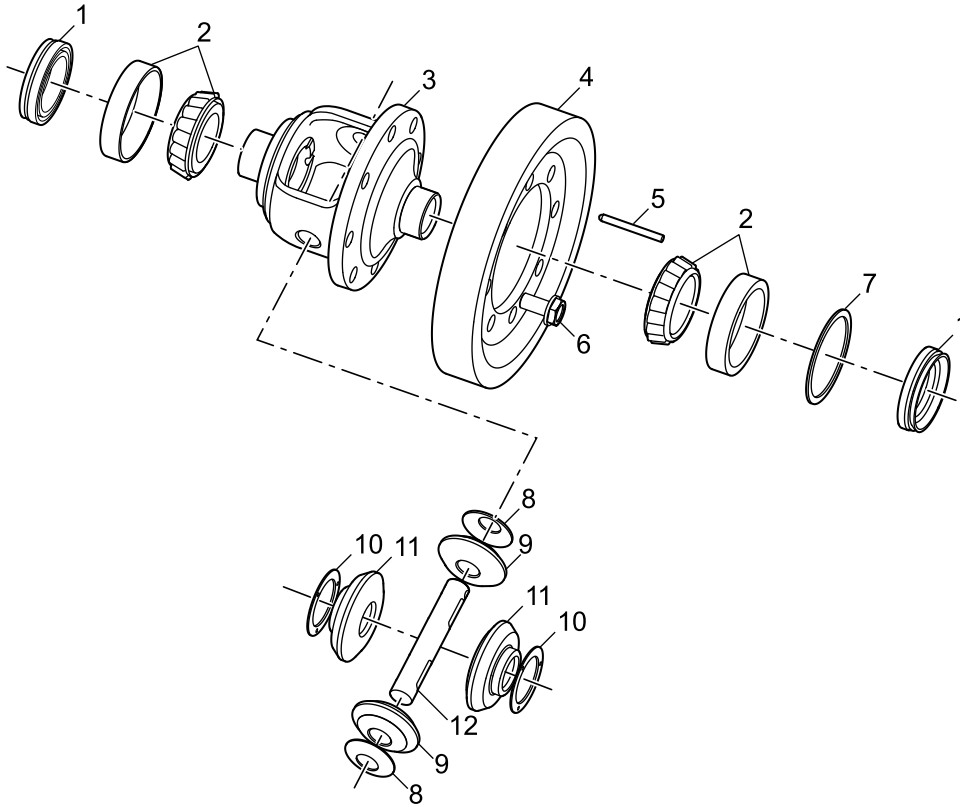
Gear Drive Mechanism



- | | |
|---|---|
| 1. Drive Shaft Front Bearing Circlip | 19. Driven Shaft Front Bearing Circlip |
| 2. Drive Shaft Front Bearing | 20. Drive, Driven Shaft Hole Oil Seal |
| 3. Bearing Cover Plate | 21. Reverse Idler Gear Shaft |
| 4. Bolt - Bearing Cover Plate | 22. Reverse Idler Gear Needle Roller Bearing |
| 5. Drive Shaft | 23. Reverse Idler Gear |
| 6. Drive Shaft 3rd Gear Assembly | 24. Reverse Idler Gear Stopper Plate |
| 7. 3rd/5th/Reverse Needle Roller Bearing | 25. Reverse Idler Gear Circlip |
| 8. 3rd/4th Synchronizer Tapered Ring | 26. Driven Shaft Front Bearing |
| 9. 3rd/4th (5th/Reverse) Synchronizer Sleeve | 27. Driven Shaft |
| 10. 3rd/4th Synchronizer Gear Hub | 28. Driven 1st Needle Roller Bearing Assembly |
| 11. 3rd/4th, 5th/Reverse Synchronizer Slider Assembly | 29. Driven 1st Gear Assembly |
| 12. 2nd Synchronizer Inner Tapered Ring | 30. 1st/2nd Synchronizer Inner Tapered Ring |
| 13. Drive Shaft 4th Gear Assembly | 31. 1st/2nd Synchronizer Middle Ring |
| 14. 4th Needle Roller Bearing Assembly | 32. 1st/2nd Synchronizer Outer Tapered Ring |
| 15. Drive Shaft 5th Gear | 33. 1st/2nd Synchronizer Sleeve |
| 16. Drive Shaft 5th Gear Retainer | 34. 1st/2nd Synchronizer Slider |
| 17. Retainer Sleeve | 35. 1st/2nd Synchronizer Gear Hub |
| 18. Drive Shaft Rear Bearing | 36. Driven 2nd Needle Roller Bearing Assembly |

- | | |
|---|---|
| 37. Driven 2nd Gear Assembly | 47. Driven Shaft Rear Bearing Stop Collar |
| 38. Driven 3rd Gear | 48. Driven Shaft Rear Bearing Circlip |
| 39. Driven Shaft 3rd/4th Spacer | 49. 3rd/4th Synchronizer Assembly |
| 40. Driven 4th Gear | 50. Tri-synchro Rings-1st/2nd Gears |
| 41. Driven 5th Needle Roller Bearing Assembly | 51. 1st/2nd Synchronizer Assembly |
| 42. Driven 5th Gear Assembly | 52. 5th/Reverse Synchronizer Assembly |
| 43. 5th/Reverse Synchronizer Gear Hub | 53. Drive Shaft Oil Seal |
| 44. Driven Reverse Needle Roller Bearing Assembly | 54. 5th Synchronizer Tapered Ring |
| 45. Driven Reverse Gear Assembly | 55. Reverse Synchronizer Tapered Ring |
| 46. Driven Shaft Rear Bearing | |

Differential Assembly



S242003

- | | |
|--|------------------------|
| 1. Propeller Shaft Oil Seal | 7. Adjusting Shim |
| 2. Cone Bearing | 8. Planetary Gear Shim |
| 3. Differential Case | 9. Planetary Gear |
| 4. Main Speed Reduction Driven Gear | 10. Side Gear Shim |
| 5. Planetary Shaft Pin | 11. Side Gear |
| 6. Bolt - Differential Housing to Main Speed Reduction Driven Gear | 12. Planetary Shaft |

Description**General Description**

This vehicle is equipped with a 5-speed manual transmission SH78ZB (1.5 VCT). The shift lever is on the passenger compartment centre console, which provides the driver with 6 options for the transmission position - 1st, 2nd, 3rd, 4th, 5th and reverse gear. The drive shaft, which transfers drive force to the wheels, is fitted in the differential assembly behind the transmission.

Transmission Case

The transmission case is made of cast aluminium, and connected to engine cylinder block by bolts. The input shaft and output shaft of transmission are supported by bearings.

The transmission case is equipped with an oil filler plug on the front lower part and a drain plug sealed by a aluminum washer on the rear lower part. Lubricant is added into the transmission to lubricate inner components by splash. The breather plug is fitted in the back of the handling base. A stamped steel sealing panel seals the opening between transmission and engine cylinder block.

Transmission Set

The front end of the input shaft has splines, which engage with the spline hub on the driven disc of the clutch. The input shaft is supported by the front bearing and bearing seat, and is arranged from the end of the cylinder block in the following order:

- 3rd Gear and Bearing
- 3rd/4th Synchronizer Gear Ring
- 3rd/4th Synchronizer Gear Hub, Synchronizer Sleeve, Synchronizer Slider Assembly
- 3rd/4th Synchronizer Gear Ring
- 4th Gear and Bearing
- 5th Gear and Bearing
- Rear Bearing and Rear Oil Seal

The reverse idler gear is supported by the reverse idler gear shaft.

The front end of the output shaft has a machined gear. The output shaft is supported by the front bearing and bearing seat, and is arranged from the end of the cylinder block in the following order:

- 1st Gear
- 1st/2nd Synchronizer Inner Tapered Ring, Middle Ring, Outer Tapered Ring, Synchronizer Gear Hub, Sleeve and Synchronizer Slider Assembly
- 2nd Gear, 3rd Gear and Bearing
- 3rd Gear
- 4th Gear, 5th Gear and Bearing

- 3rd/4th/5th/Reverse Synchronizer Gear Ring
- 5th/Reverse Synchronizer Gear Hub, Sleeve and Synchronizer Slider Assembly
- Reverse Gear and Bearing
- Rear Bearing

The transmission has the following speed ratios:

| Gear Position | Speed Ratio |
|----------------------|-------------|
| 1st Gear | 3.583 |
| 2nd Gear | 2.105 |
| 3rd Gear | 1.379 |
| 4th Gear | 1.030 |
| 5th Gear | 0.820 |
| Reverse Gear | 3.363 |
| Main Speed Reduction | 4.389 |

Shift and Select

Gear selection is done by operating the shift lever fitted on the centre console of the passenger compartment. The ends of the two cables in one side are connected to the bottom of the shift lever. The other ends pass through the centre path, and are connected with select rocker arm and shift rocker arm on the outside of the transmission by the union ring set, and fixed by screws. The shift fork shaft and shift fork in the transmission case are connected.

Reverse Gear Protection and Reverse Gear Switch

Reverse lock-up mechanism is used to prevent shifting directly from 5th to reverse by accident. Plunger type back-up light switch is fitted on the rear transmission case.

Differential

For a traditionally-designed differential, the main speed reduction driven gear is secured to the differential housing with bolts, and the differential housing supports the planetary shaft pin, planetary gear and sun gear. Differential assembly is in the transmission case and supported by the cone bearing.

Operation**Transmission Set**

Drive train changes the speed and direction of rotation through the engagement of different gears on the input shaft and output shaft, resulting in 5 forward gears with different speed ratios and 1 reverse gear. Except the reverse gear, gears continuously engage in all other gears. When selecting 1st gear, synchronizer sleeve applies pressure to the synchronizer gear ring to make it touch the tapered ring corresponding to the selected gear. This makes the synchronizer gear hub and the gear maintain the same speed. And then, synchronizer sleeve extends into gear through the synchronizer slider assembly and extended-teeth of synchronizer sleeve. The shift head of the gear shift shaft ensures accurate gear selection, and the gear keeps in operation position. The torque is transferred to input shaft of the transmission from the engine through the clutch. And then, through the selected gear, the torque is transferred to the pinion of the output shaft and the main speed reduction driven gear, then to the drive shaft. The operation of 2nd, 3rd, 4th and 5th is the same as that of 1st. When selecting reverse gear, the reverse gear (integrated with input shaft) engages with the output shaft reverse gear and reverse idler gear to change the rotation direction of the output shaft, achieving the reverse.

Shift and Select

When moving the shift lever to 1st gear, the shift lever operates the gear shift rocker arm through the cable. Select rocker arm is rotated by the torque of the cable to pull the gear shift shaft outward, the gear shift arm guide on the gear shift shaft is moved outward accordingly to the groove of 1st/2nd shift selector, at this time, the gear shift arm guide should disengage from the groove of 3rd/4th arm guide completely. One end of interlock ring will get caught in the groove of 3rd/4th and 5th/reverse shift selector, and the other end will disengage from the groove of 1st/2nd shift selector completely. After that, the gear shift shaft is rotated by the shift rocker arm through the torque of the cable, the gear shift arm guide will rotate together with the gear shift shaft, one side of the gear shift arm guide will flip the 1st/2nd shift selector, which will drive the 1st/2nd synchronizer to achieve the gear shift function of the 1st. The operation of other gears is the same as that of the 1st.

Reverse Protection

When selecting the 5th, the reverse lock block acts on the outside of the reverse lock stopper plate by the torque of the torsional spring. When switching to 5th, the reverse lock block is free from the reverse lock stopper plate, with the torque of the torsional spring, it will return to normal position. When 5th is directly switched to reverse, the reverse lock block will rotate in the opposite direction, and the reverse lock stopper

plate will stop it. Thus, it avoids 5th being switched to reverse directly.

Differential

The differential allows wheels to turn at different speeds while they output the same torque. The pinion integrated with the output shaft engages with the main speed reduction driven gear of the differential assembly. When the output shaft rotates and the wheels move straight forward, the torque is applied to the whole assembly, but the planetary gear does not rotate. The torque is transferred to wheels by the drive shaft.

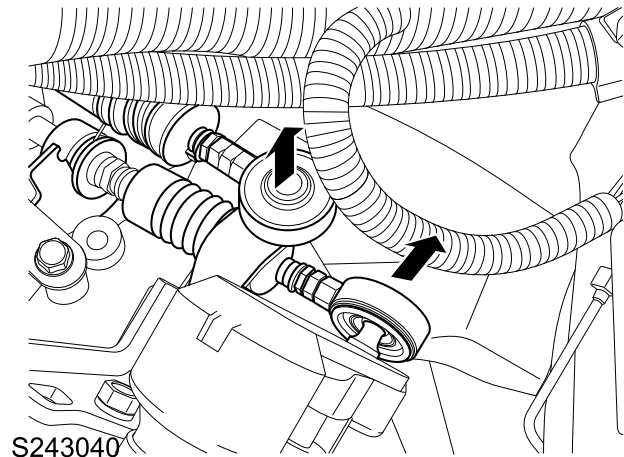
When the vehicle turns, the inside wheels travel a shorter distance at a slow speed. This makes the planetary gear rotate, the outside sun gear provides outside wheels with a faster speed.

Service Procedures**Gear Shift Shaft Oil Seal - Manual****Removal**

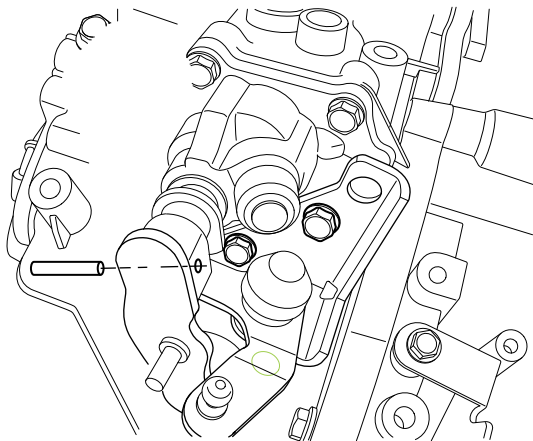
1. Remove the battery box.

👉 Battery Box Removal

2. Make sure that the shift lever is in neutral.
3. Notice the mounting position and release the gear shift cable ball joint from the gear shift rocker arm of the manual transmission.



4. Remove 2 bolts securing the gear shift bracket to the handling base of the transmission and remove the bracket.



5. With the assistance, support the shift rocker arm, remove the cylindrical pin securing it, and then remove the shift rocker arm.
6. Remove and dispose of the gear shift shaft oil seal.

Refit

1. Clean the mating surfaces of the gear shift shaft oil seal groove, the gear shift bracket and the transmission handling base.
2. Fit the new oil seal to the gear shift bracket and ensure the stepped portion of the oil seal faces outward.
3. Fit the shift rocker arm and fix it with a new cylindrical pin.
4. Fix the gear shift bracket to the handling base of

transmission and tighten the bolt to **22-30 Nm**.

5. Connect the cable ball joint to gear shift rocker arm.
6. Check shift quality, if it is difficult to shift under high friction load condition, it indicates that the fitting is not correct. Remove the assembly and refit as instructions.
7. Fit the battery box.

👉 Battery Box Refit

Manual Transmission Fluid - Drain and Refill

Drain and Refill

1. Remove the bottom wind deflector panel.

Bottom Wind Deflector Panel Removal

2. Place a proper container under the transmission.
3. Clean the area around drain plug, remove the drain plug and dispose of the gasket seal.
4. Drain the transmission fluid.
5. Clean the refill hole and the drain plug.
6. Place a new gasket seal on the drain plug, fit and tighten the drain plug to **30-40 Nm**.
7. The transmission fluid is added into the transmission through the refill hole by using the proper and clean funnel until reaching to the specified value.

| | |
|------------------|-------|
| Drain and Refill | 2.0 L |
| Dry Fill | 2.2 L |

Tip: Filler thread minor diameter Φ is 14.38 mm.

8. Place a new gasket seal on the oil filler plug, fit and tighten the oil filler plug to **30-40 Nm**.
9. Fit the bottom wind deflector panel.

Bottom Wind Deflector Panel Refit

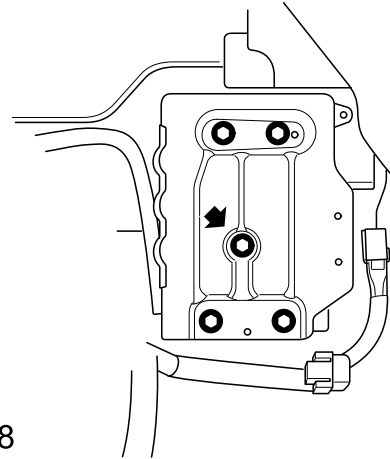
Manual Transmission Assembly

Removal

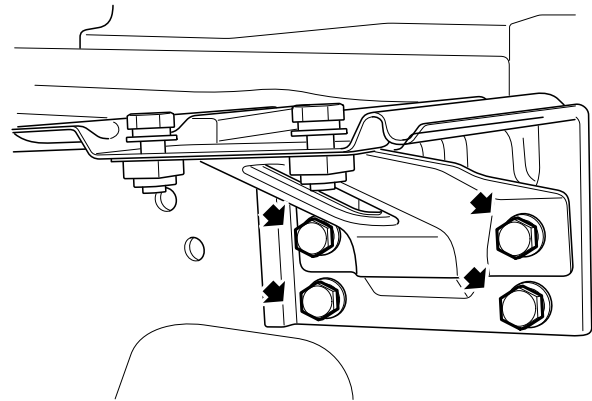
1. Remove the battery box.

Battery Box Removal

2. Remove the bolts securing the battery tray, and remove the battery support.



S111N008

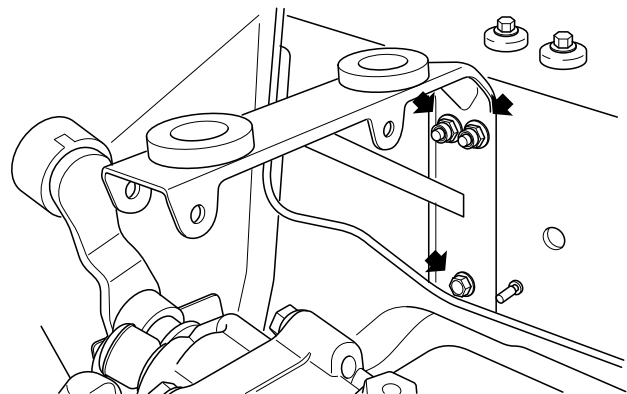


S111N009

3. Remove the air cleaner assembly.

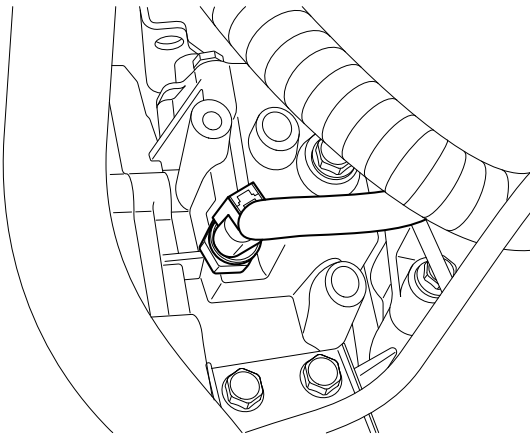
Air Cleaner Assembly Removal

4. Remove the bolts and nuts securing the air cleaner bracket and remove the bracket.



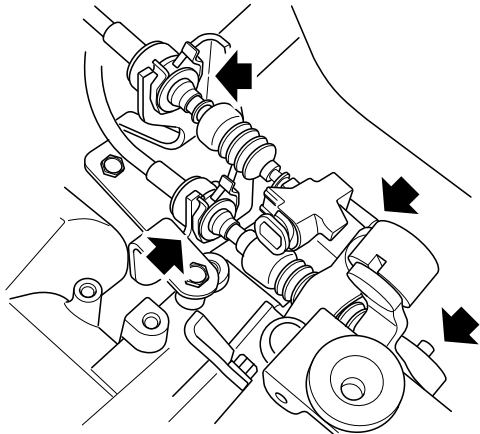
S111N007

5. Disconnect the back-up light switch connector and release the wire harness retaining snap fit.



S243039

6. Release 2 snap fits securing the positive battery cable to the bracket.
7. Notice the mounting position and release two cable ball joints from the gear shift rocker arm of the manual transmission.



8. Release the snap fits and release the outer gear shift cable from the cable bracket.
9. Drain the transmission fluid.

Drain Transmission Fluid

10. Remove the drive shaft assembly.

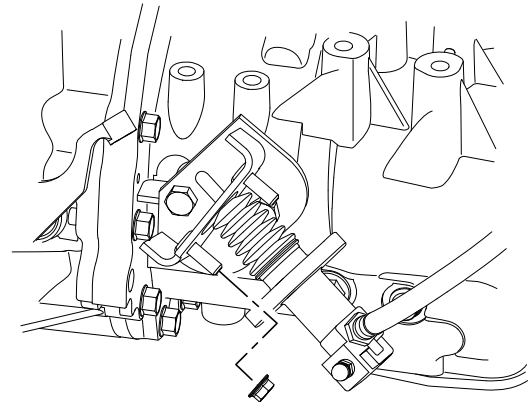
Drive Shaft Assembly RH Removal

Drive Shaft Assembly LH Removal

11. Remove the starter motor.

Starter Motor Removal

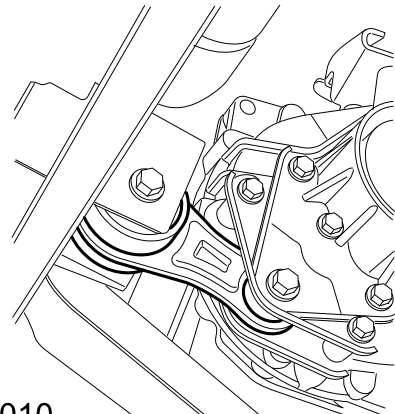
12. Loosen 2 nuts securing the slave cylinder to the slave cylinder bracket of the manual transmission, release and temporarily set the slave cylinder aside.



S223017

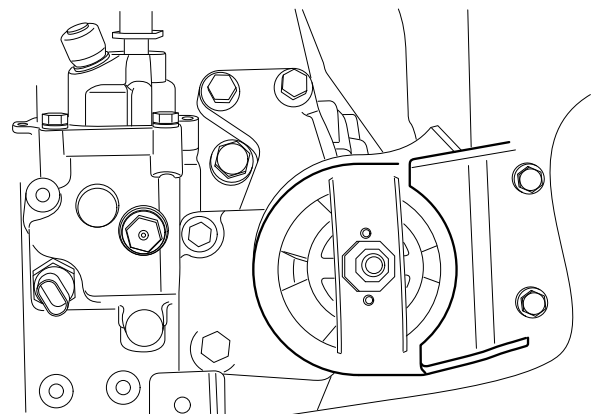
Caution: DO NOT hang the slave cylinder for a long time.

13. Support the engine with hanger.
14. Support the manual transmission with a jack.
15. Remove 7 service bolts connecting the engine and manual transmission.
16. Remove the service bolts between the lower tie rod and the bracket of the lower tie rod and loosen the service bolts and nuts between the lower tie rod and the front sub frame.



S111N010

17. Remove the nuts between the manual transmission mounting bracket and suspension.



S111N011

18. Release transmission from the engine, and adjust the height of the jack and carefully and slowly lower the

transmission to the floor.

19. Loosen 4 retaining bolts, and remove the mounting bracket of the manual transmission.

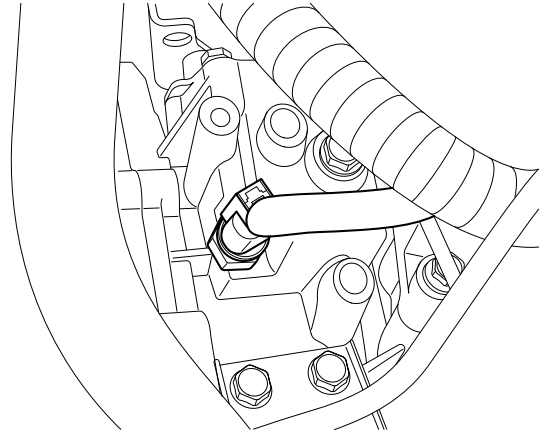
Refit

1. Clean the mating surfaces of the parts.
2. Fit the back-up light switch to the transmission and tighten it to **32-44 Nm**.
3. Connect the back-up light switch connector.
4. Connect the battery earth lead.

Back-up Light Switch - Manual

Removal

1. Disconnect the battery earth lead.



S243039

2. Disconnect the connector from the back-up light switch.
3. Remove the back-up light switch from the transmission.

Refit

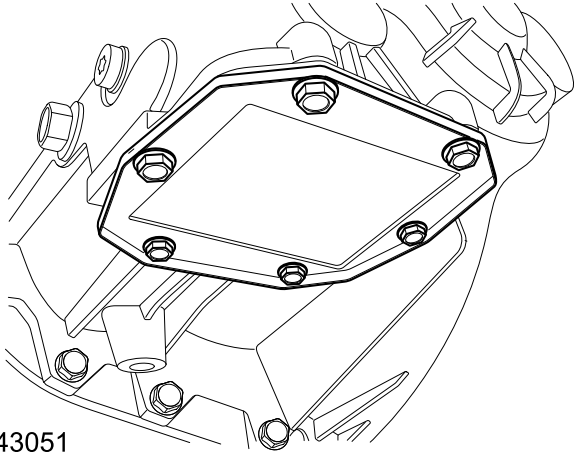
1. Clean the mating surfaces of the parts.
2. Fit the back-up light switch to the transmission and tighten it to **32-44 Nm**.
3. Connect the back-up light switch connector.
4. Connect the battery earth lead.

Rear Housing Deck Board - Reseal - Manual**Removal**

1. Drain the transmission fluid.

👉 Drain

2. Place a proper container to collect the overflowed fluid.
3. Remove 6 bolts securing the rear housing deck board to the transmission housing.



S243051

4. Carefully tear the seal packing connection to release the deck board from the transmission housing.

Refit

1. Clean the mating surfaces of the parts.
2. Apply the flat seal Kesaixin 1598 black silicon rubber to the mating surface of the transmission housing.
3. Place the deck board, fit the bolt and tighten to **10-14 Nm**.
4. Refill the transmission.

👉 Manual Transmission Fluid - Refill**Differential Oil Seal LH - Manual****Removal**

1. Remove the drive shaft LH.

👉 Drive Shaft Assembly LH

2. Carefully remove and dispose of the oil seal, take care not to damage the oil seal groove.

Refit

1. Clean the oil seal groove.

Caution: *The oil seals are waxed and not need to be lubricated before fitting.*

2. Use tool **T24010** to fit a new oil seal.
3. Fit the drive shaft LH.

👉 Drive Shaft LH Refit

4. Add the transmission fluid.

👉 Transmission Fluid Adding

Differential Oil Seal RH - Manual

Removal

1. Remove the drive shaft RH.

 **Drive Shaft Assembly RH Removal**

2. Carefully remove and dispose of the oil seal, take care not to damage the oil seal groove.

Refit

1. Clean the oil seal groove.

Caution: *The oil seals are waxed and not need to be lubricated before fitting.*

2. Use tool **T24010** to fit a new oil seal.
3. Fit the drive shaft RH.

 **Drive Shaft RH Refit**

4. Add the transmission fluid.

 **Transmission Fluid Adding**

Manual Transmission Disassembly


Removal

Caution: *Prepare a clean desk and a box to place the removed parts.*

1. Remove the manual transmission assembly.

 **Manual Transmission Assembly Removal**

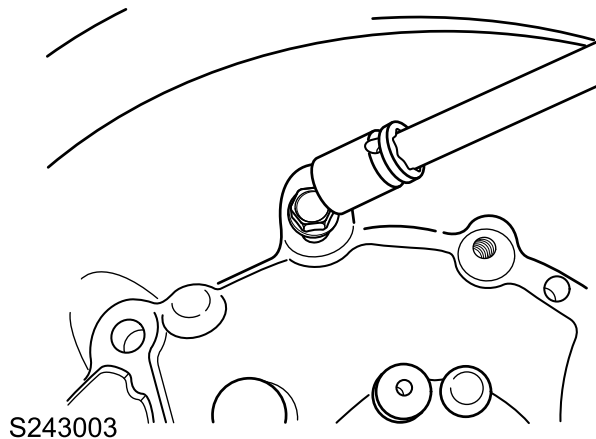
2. Remove the operating mechanism.
3. Remove the release mechanism.

 **Transmission Accessory and Release Mechanism Removal**

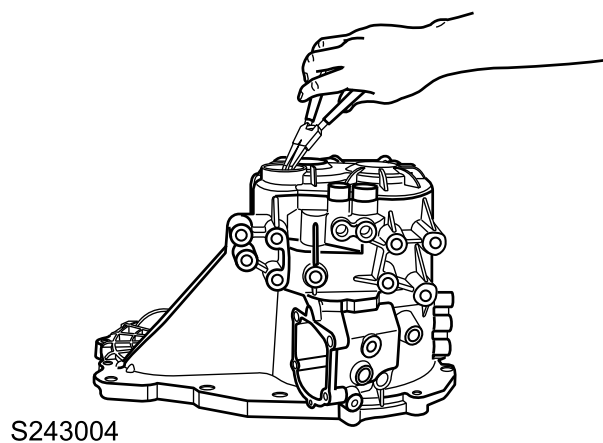
4. Remove each outer bracket and the reverse idler gear etc.

 **Reverse Idler Gear Removal**

5. Remove the service bolts of the front and rear housing.

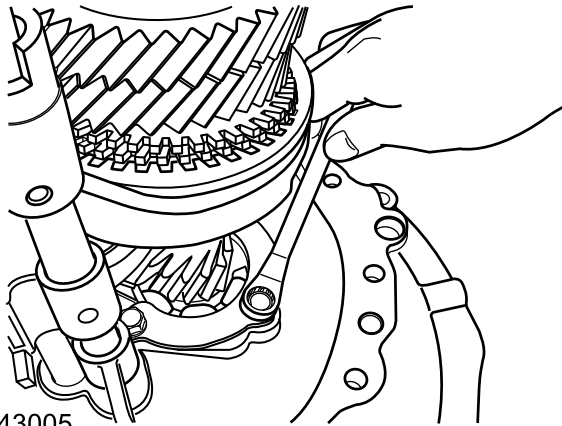


6. Separate the front and rear housing.



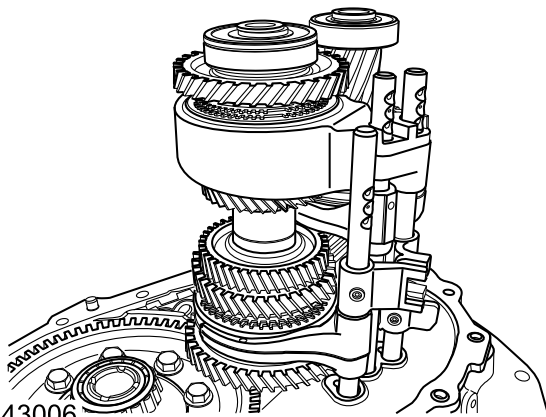
Caution: *When separating the front and rear housing, expand the stop collar with circlip pliers and tap the rib of the rear housing with nylon hammer to separate them.*

7. Remove the bearing cover plate.



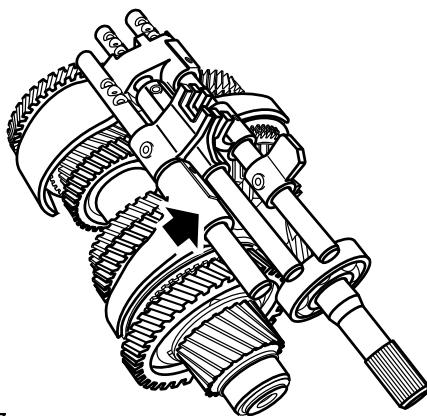
S243005

8. Remove the main driven shaft, forks and fork shafts together from the housing.



S243006

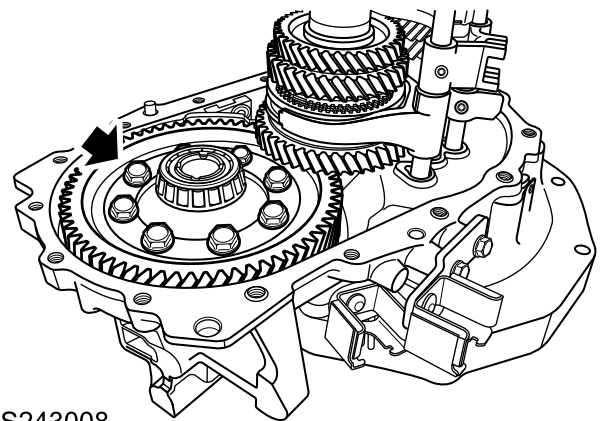
9. Remove the fork shafts and each selector and fork etc.



S243007

Caution: It is necessary to take measures to prevent bend when removing each fork shaft.

10. Remove the differential assembly.



S243008

Refit

Caution: lean all the components and packings before assembling.

Caution: Use the original transmission fluid to lubricate the bearing, running parts, slideway, seat and pressure surface.

Caution: Check the components for signs and damage of wearing and scratching, and replace as necessary.

Caution: Refer to the "specification" for the tightening torque.

Caution: Apply sealant or seal lock adhesive to the threaded parts.

1. On the front housing, use **T24011** to press and fit the drive shaft oil seal, and use **T24010** to press and fit the propeller shaft oil seal and fit driven shaft front bearing outer race, and use **T24012** to press and fit the cone bearing outer race, and use **T24013** to press and fit 1st/2nd shift fork bushing etc.
2. Fit the shaft and shift fork set into front housing, fit the bearing cover plate and tighten it to **22-30 Nm**.
3. Fit the differential assembly and tighten the bolts to **140-170 Nm**.

Caution: When the fitting is finished, check that the torque range is between 4-6 Nm with cone bearing preload torque gauge.

4. On rear housing, use **T24014** to press and fit guide nozzle, driven shaft rear bearing stop collar.

Caution: Select the stop collar based on bearing. The series are as follows:

| Thickness (mm) |
|----------------|
| 1.90 |
| 1.875 |
| 1.85 |

| |
|-------|
| 1.825 |
| 1.80 |

5. Measure the thickness of the removed shim and select a new adjusting shim according to the thickness, and use **T24012** to press it into the cone bearing outer race.

Caution: The shim series are as follows:

| Thickness (mm) | Color |
|----------------|--------|
| 1.0±0.01 | Yellow |
| 0.8±0.01 | Green |
| 0.5±0.01 | Red |
| 0.2±0.01 | White |
| 0.15±0.01 | Black |
| 0.1±0.01 | Purple |

6. On rear housing, use **T24013** to fit 1st/2nd fork shaft bushing, and use **T24015** to press and fit gear shift shaft needle roller bearing, and use **T24010** to press and fit the propeller shaft oil seal etc.
7. Fit the rear housing into the front housing, and tighten the bolts to **30-40 Nm**.
8. Fit the operating mechanism into the rear housing and tighten the bolts to **22-30 Nm**.
9. Fit reverse idler gear assembly.

👉 Idler Gear Assembly Refit

10. Fit the cover, the rear housing deck board etc. and tighten the retaining bolts of the rear housing deck board to **10-14 Nm**.

Caution: Apply the rear housing deck board with flat seal Kesaixin 1598 black silicon rubber.

11. Fit the release mechanism etc.

👉 Transmission Accessory and Release Mechanism Refit

12. Fit the bracket, screws etc. and tighten them to **22-30 Nm**.

Drive Shaft Assembly

Removal

Caution: Prepare a clean desk and a box to place the removed parts.

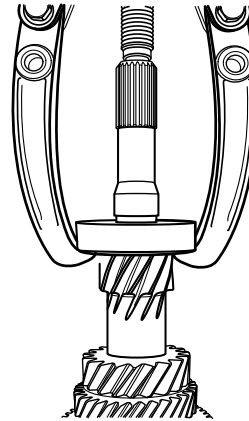
1. Remove the transmission assembly.

👉 Manual Transmission Assembly Removal

2. Remove the drive shaft.

👉 Manual Transmission Disassembly

3. Remove the drive shaft front bearing circlip.
4. Use **T32001** to pull out the drive shaft front bearing.

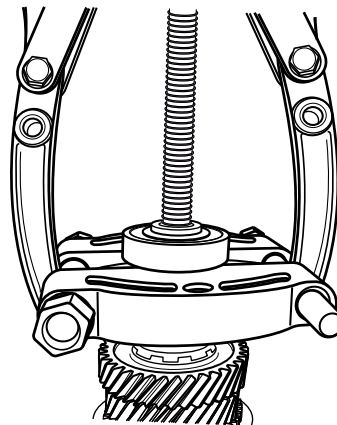


S243009

5. Remove the drive shaft hole oil seal.

Caution: Discard oil seals after removing.

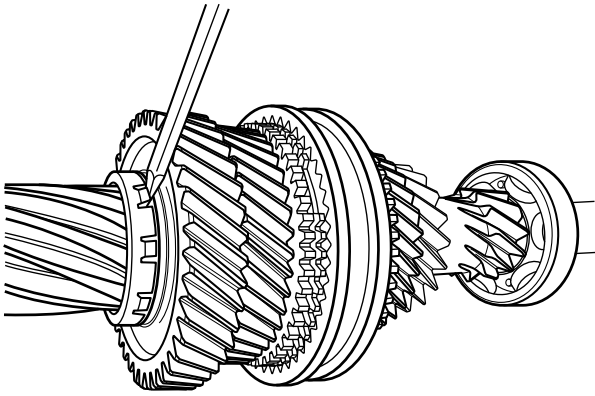
6. Remove the bearing circlip.
7. Use **T32001** to pull out the drive shaft rear bearing.



S243010

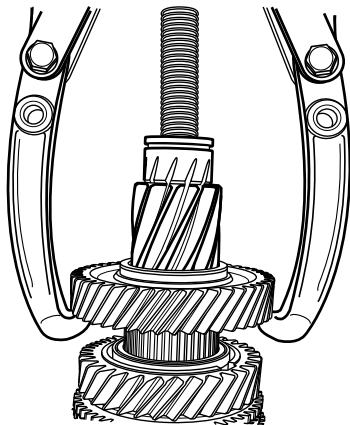
8. Remove the retainer sleeve.

Caution: Discard it after removing.



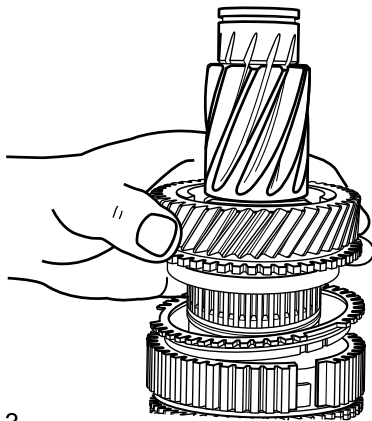
S243011

9. Remove the retainer.
10. Use **T32001** to pull out the drive shaft 5th gear.



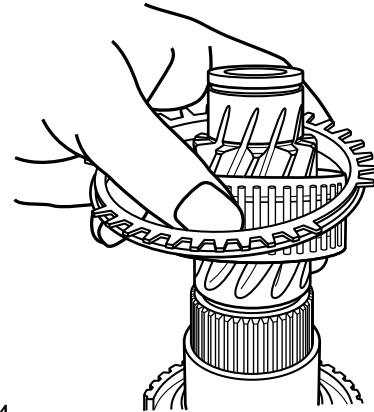
S243012

11. Remove the drive shaft 4th gear assembly.



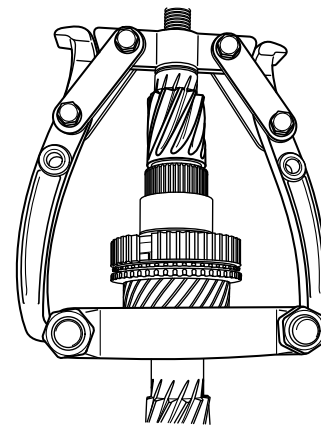
S243013

12. Remove the drive shaft 4th gear needle roller bearing.
13. Remove the 4th synchronizer gear ring.



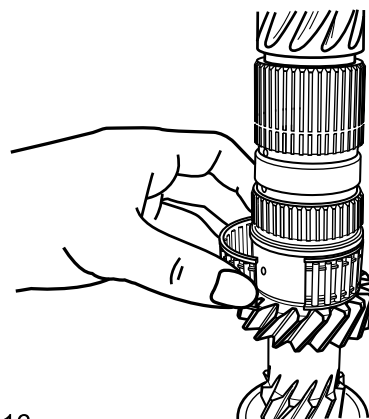
S243014

14. Remove the synchronizer sleeve.
15. Remove the synchronizer gear hub and slider assembly.
16. Remove the 3rd synchronizer gear ring.
17. Use **T32001** to pull out the drive shaft 3rd gear assembly.



S243015

18. Remove the 3rd gear needle roller bearing.



S243016

Refit

Caution: *lean all the components and packings before assembling.*

Caution: *Fit new circlip after fitting the bearing.*

Caution: Use the original transmission fluid to lubricate the bearing, running parts, slideway, seat and pressure surface.

Caution: Check the components for signs and damage of wearing and scratching, and replace as necessary.

1. With the pressure of press machine and the assistance of **T24001**, fit the drive shaft front bearing into place.
2. Measure and select a new drive shaft front bearing circlip to fit.

Caution: The circlip series are as follows:

| Thickness (mm) | | |
|----------------|------|---------|
| L1 | 2.30 | Red |
| L2 | 2.33 | White |
| L3 | 2.36 | Natural |
| L4 | 2.39 | Green |

3. Lubricate 3rd needle roller bearing and fit it to the shaft.
4. Fit 3rd gear assembly.
5. Position 3rd synchronizer gear ring.
6. Press in the synchronizer gear hub and fit the slider assembly and sleeve.

Caution: Fitting direction of the hub and sleeve.

7. Use **T24002** to press in 4th gear needle roller bearing inner race and fit the needle roller bearing.

Caution: Lubrication of the needle roller bearing.

8. Position the gear ring of 4th gear and 4th gear assembly.
9. Press in 5th gear.
10. Measure and select 2 new semicircular retainers to fit.

Caution: The retainer series are as follows:

| Thickness (mm) | | |
|----------------|------|---------|
| L1 | 3.85 | White |
| L2 | 3.89 | Purple |
| L3 | 3.93 | Natural |
| L4 | 3.97 | Red |
| L5 | 4.01 | Green |
| L6 | 4.05 | Blue |
| L7 | 4.09 | Pink |
| L8 | 4.13 | Yellow |
| L9 | 4.17 | Brown |

11. Fit the retainer sleeve.
12. With the assistance of press machine and **T24003**, fit the rear bearing.
13. Fit the bearing circlip.

14. With the assistance of **T24004**, tap in the drive shaft hole oil seal.

Caution: Lubricate the oil seal.

Driven Shaft Assembly

Removal

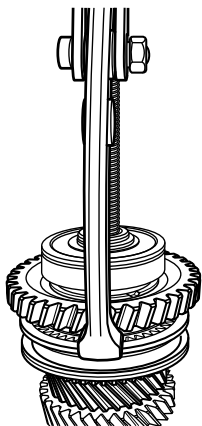
1. Remove the transmission assembly.

 **Manual Transmission Assembly Removal**

2. Remove the driven shaft assembly.

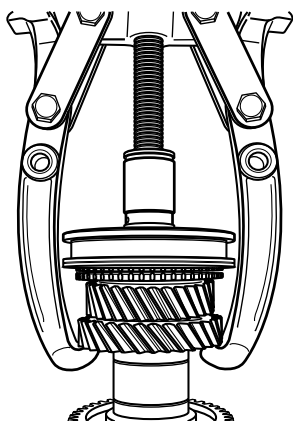
 **Manual Transmission Disassembly**

3. Remove the bearing circlip. (If the front bearing is damaged, replace the driven shaft and front bearing set.)
4. Remove the driven shaft rear bearing circlip.
5. Use **T32001** to pull out the driven shaft rear bearing and the reverse needle roller bearing inner race.



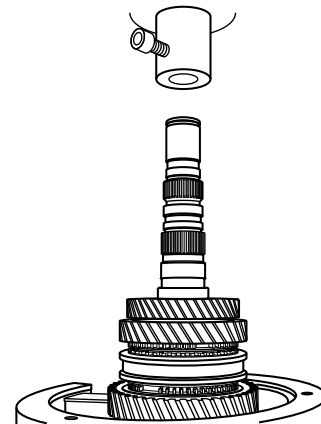
S243017

6. Remove the reverse gear assembly and needle roller bearing etc.
7. Use **T32001** to pull out the 4th gear, 5th gear needle roller bearing inner races and synchronizer etc. together.



S243018

8. Remove the middle spacer.
9. Use a press to press the driven shaft 1st gear assembly, synchronizer assembly, 2nd gear assembly and 3rd gear assembly etc.



S243019

Refit

Caution: Fit new circlip after fitting the bearing.

Caution: Check the components for signs and damage of wearing and scratching, and replace as necessary.

1. Use **T24005** to press and fit the 1st needle roller bearing inner race.
2. Position the 1st needle roller bearing.
3. Position the driven 1st gear assembly.
4. Position 1st/2nd synchronizer gear inner tapered ring, middle ring and outer tapered ring.

Caution: Fitting direction of the three.

5. Press and fit 1st/2nd synchronizer gear hub, sleeve and slider assembly.

Caution: Fitting direction.

6. Position the 1st/2nd synchronizer inner tapered ring, middle ring and outer tapered ring.

Caution: Fitting direction.

7. Use **T24006** to press and fit the driven 2nd needle roller bearing inner race.
8. Position the driven 1st needle roller bearing.
9. Position the driven 2nd gear assembly.
10. Press and fit the driven shaft 3rd gear.
11. Measure and position the 3rd/4th spacers.

Caution: The spacer series are:

| Thickness (mm) |
|----------------|
| 22.33 |
| 22.43 |
| 22.53 |
| 22.63 |
| 22.73 |

12. Use **T24007** to press and fit the driven shaft 4th gear.

13. Press and fit the 5th needle roller bearing inner race.
14. Position 3rd/5th/reverse needle roller bearing.

Caution: Lubrication of the needle roller bearing.

15. Position the driven 5th gear.
16. Position 3rd/4th, 5th/reverse synchronizer gear ring.
17. Press and fit 5th/reverse synchronizer gear hub, sleeve and slider assembly.

Caution: Fitting direction.

18. Position 3rd/4th, 5th/reverse synchronizer gear ring.

Caution: Fitting direction.

19. Use **T24008** to press and fit the reverse needle roller bearing inner race.
20. Position 3rd/5th/reverse needle roller bearing.
21. Position the reverse gear, and use the bearing press-fitting tool to press and fit the driven shaft rear bearing, and use the circlip pliers to set the rear bearing circlip into place.

Caution: The circlip series are as follows:

| | Thickness (mm) | |
|-----|----------------|--------------|
| L1 | 2.42 | Light Gray |
| L2 | 2.46 | Natural |
| L3 | 2.50 | Green |
| L4 | 2.54 | Brown |
| L5 | 2.58 | Blue |
| L6 | 2.62 | Light yellow |
| L7 | 2.66 | Pink |
| L8 | 2.70 | Red |
| L9 | 2.78 | Purple |
| L10 | 2.82 | White |
| L11 | 2.86 | Cyan |

22. Select and fit the driven shaft rear bearing stop collar.

Caution: The stop collar series are:

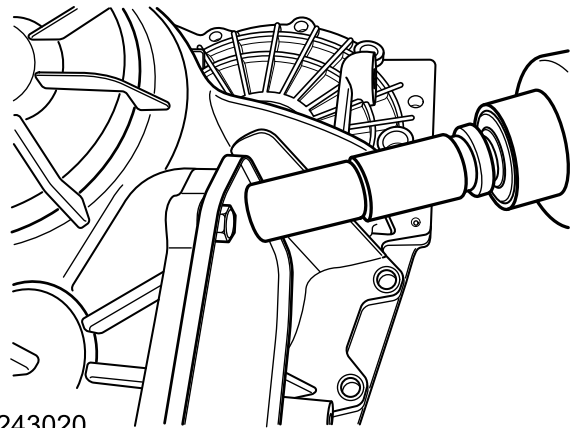
| Thickness (mm) |
|----------------|
| 1.90 |
| 1.875 |
| 1.85 |
| 1.825 |
| 1.80 |

23. Use the bearing press-fitting tool to press and fit the driven shaft front bearing.
24. Use the circlip pliers to set the front bearing circlip into place.

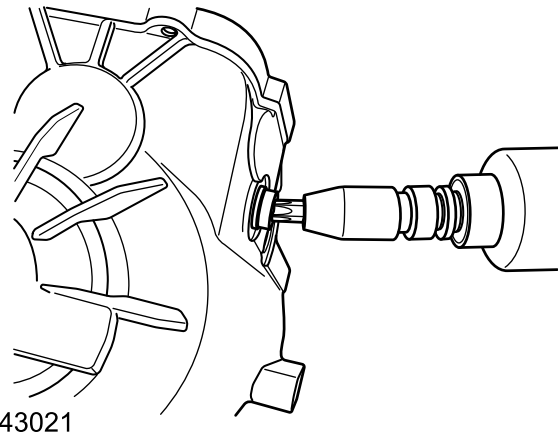
Reverse Idler Gear

Removal

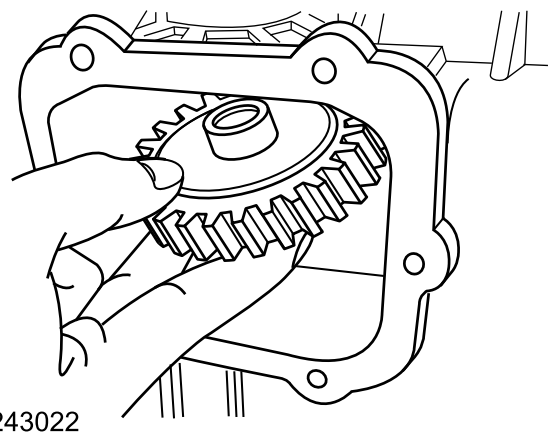
1. Remove the rear housing deck board.



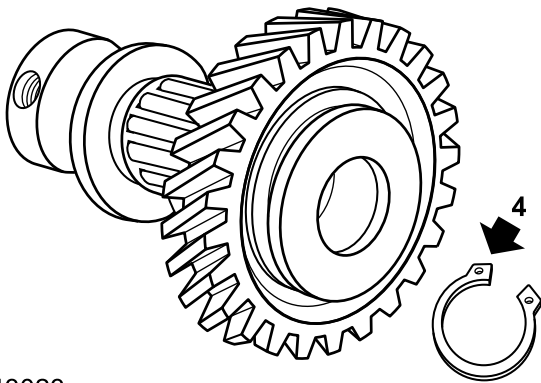
2. Remove the reverse bolts.



3. Take out the reverse idler gear assembly.



4. Remove the reverse idler gear circlip.



S243023

5. Remove the stopper plate/needle roller bearing/idler gear in sequence.

Refit

Caution: The new circlip must be fitted.

1. Fit the needle roller bearing/idler gear into the reverse idler gear shaft in sequence.

Caution: Lubrication of the needle roller bearing.

2. Fit the reverse idler gear circlip.
3. Fit the rear housing and tighten the bolts to **32-44 Nm**.
4. Fit the rear housing deck board and tighten the bolts to **10-14 Nm**.

Differential Assembly**Removal**

Caution: Discard shims after removing.

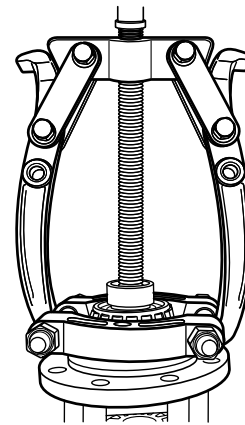
1. Remove the transmission assembly.

 **Manual Transmission Assembly Removal**

2. Remove the differential assembly.

 **Manual Transmission Disassembly**

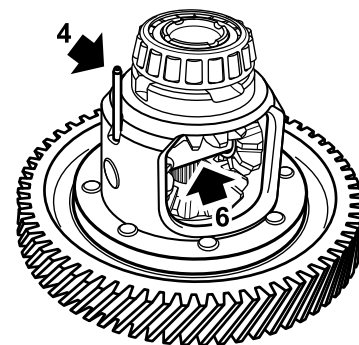
3. Use **T32001** to pull out the cone bearing inner race and take out the shims.



S243024

Caution: Support bolt of the drawing die (T32001) cannot be used to support the propeller shaft hole directly, place a spacer block between them.

4. Remove the planetary shaft pin with a punch.

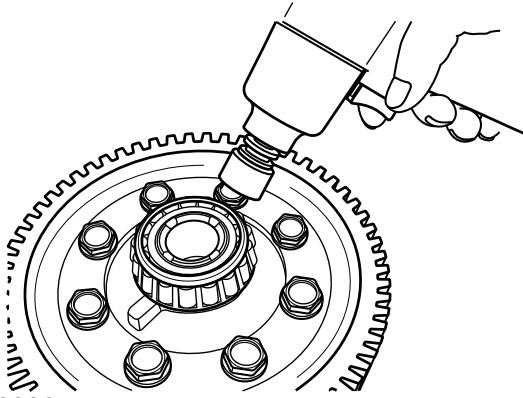


S243025

5. Unscrew the bolts and remove the main reduction driven gear.

aces.

15. Tighten the 8 bolts to **140-170 Nm**.



S243026

6. Remove the planetary shaft, take off the planetary gear, side gear and shim.

Refit

1. Put the auxiliary shafts in the side gear holes on both ends of the differential case, and fit the side gear.
2. Turn and fit the planetary gear and planetary gear shim.
3. Fit the planetary gear auxiliary shaft.
4. Measure the thickness of the removed side gear shim, and select a new shim according to the thickness.

Caution: The shim series are as follows:

| Thickness (mm) | | |
|----------------|-----------|--------|
| H | 0.90±0.01 | Yellow |
| H | 0.95±0.01 | Green |
| H | 1.00±0.01 | Blue |
| H | 1.05±0.01 | Red |
| H | 1.10±0.01 | White |
| H | 1.15±0.01 | Black |
| H | 1.20±0.01 | Purple |
| H | 1.25±0.01 | Orange |
| H | 1.30±0.01 | Brown |
| H | 1.35±0.01 | Gray |

5. Remove the differential internal parts.
6. Fit the 2 selected side gear shims.
7. Place 2 side gears.
8. Place 2 planetary gear shims.
9. Place 2 planetary gears.
10. Press out the auxiliary planetary shaft and press in the planetary shaft.
11. Press-fit the planetary shaft pin.
12. Press-fit the main reduction driven gear.
13. Place the bolts of main reduction driven gear.
14. Use **T24009** to press-fit the front, rear bearing inner

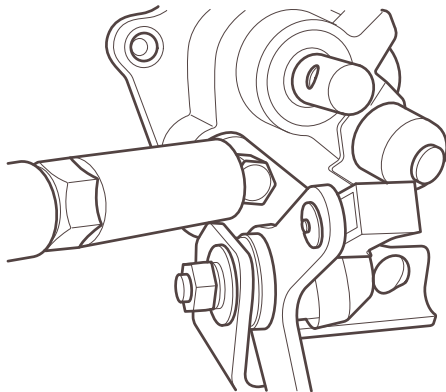
Handling Base Assembly

Removal

1. Remove the transmission assembly.

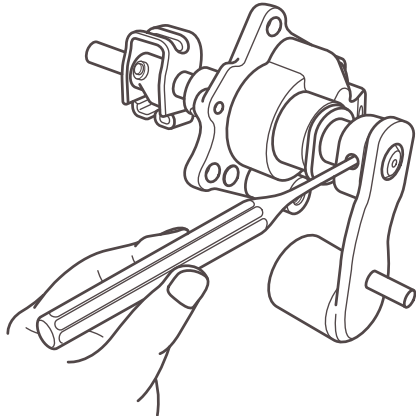
Manual Transmission Assembly Removal

2. Remove the bolts of interlock ring.
3. Unscrew the bolts from handling base to housing and remove the handling base assembly.
4. Remove the bolts of select rocker arm bracket and take it off.

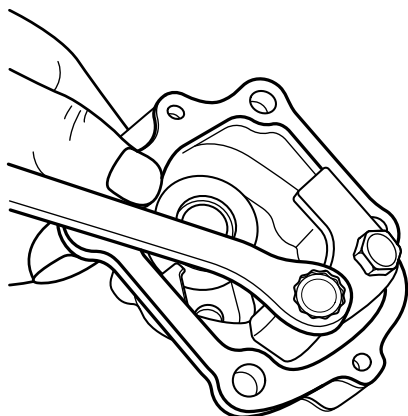


S243027

5. Punch down each pin and take out the gear shift shaft.

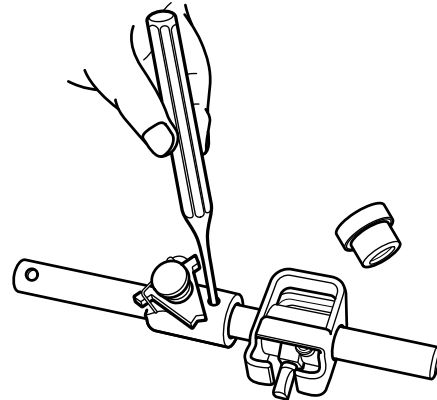


6. Remove the bolts of reverse lock stopper plate and take off the reverse lock stopper plate.



S243029

7. Remove the 5/R gear return spring, interlock ring, gear shift arm guide, reverse lock block assembly, 1/2 gear return spring, spring retainer, needle roller bearing, oil seal, shift rocker arm assembly, nylon block and breather plug, etc.



S243030

Refit

1. Use **T24017** to press in $\Phi 3$ spring pin, and use **T24024** to press-fit the reverse lock block shaft, assemble the reverse lock block assembly.
2. Fit handling base breather plug, use **T24016** to press-fit oil seal, and use **T24015** to press-fit the needle roller bearing, fit the spring retainer plate and reverse lock stopper plate and tighten the bolts to **18-26 Nm**.

Caution: Take care to avoid damaging the oil seal lip while fitting the oil seal.

3. Pass the shaft through handling base and fit 5/R return spring assembly, interlock ring, arm guide, reverse lock block assembly, 1/2 gear return spring, return spring stopper plate in sequence.

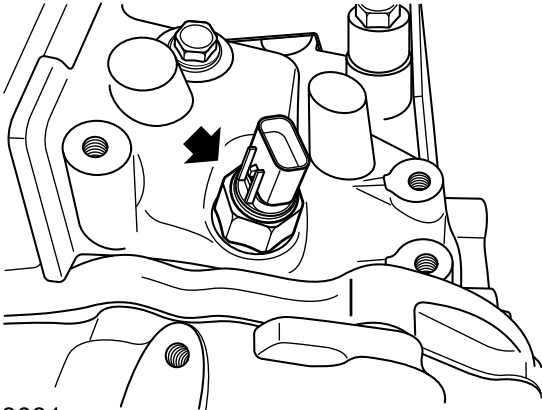
Caution: Phase relationship of each component on the shaft.

4. Fit the shift rocker arm assembly to the shaft.
5. Fit the above assembled components into the housing together and tighten the interlock ring location pin to **30-40 Nm**.
6. Place the nylon block and fit the select rocker arm assembly.

Transmission Accessory and Release Mechanism

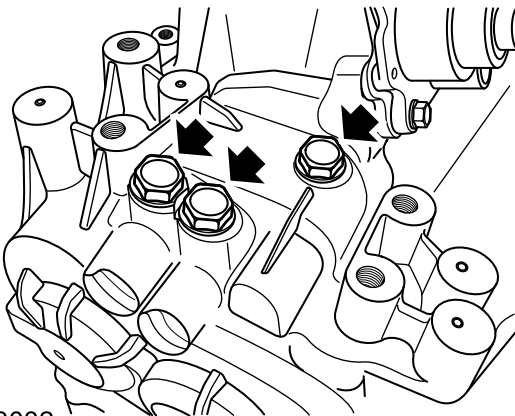
Removal

1. Remove the cylinder bracket.
2. Remove the gear shift bracket.
3. Remove the back-up light switch.



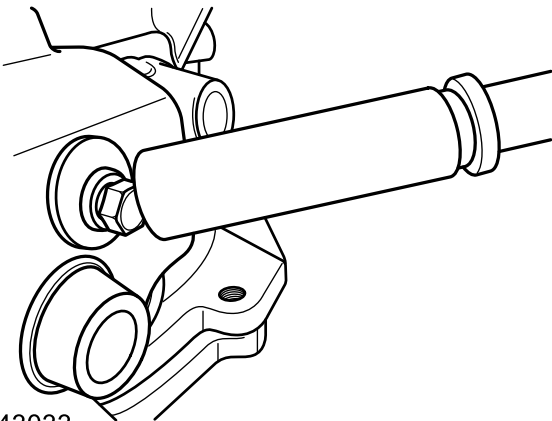
S243031

4. Remove the self-locking pin assembly.



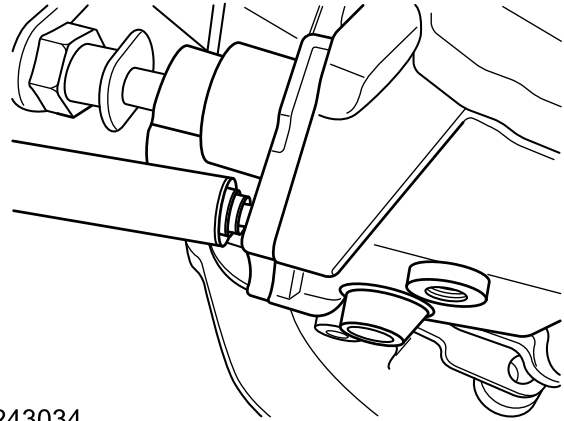
S243032

5. Remove the refill plug and drain plug.
6. Remove the interlock ring location pin.



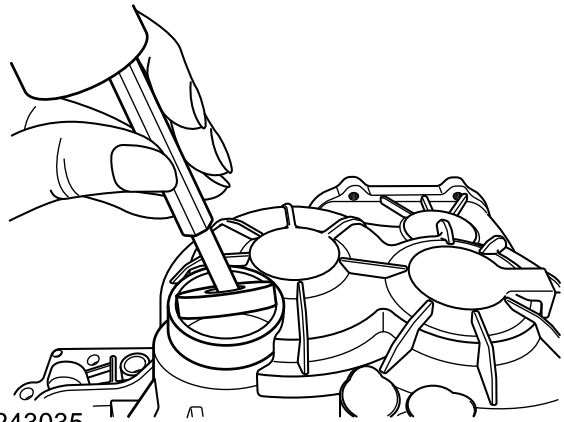
S243033

7. Remove the handling base assembly.



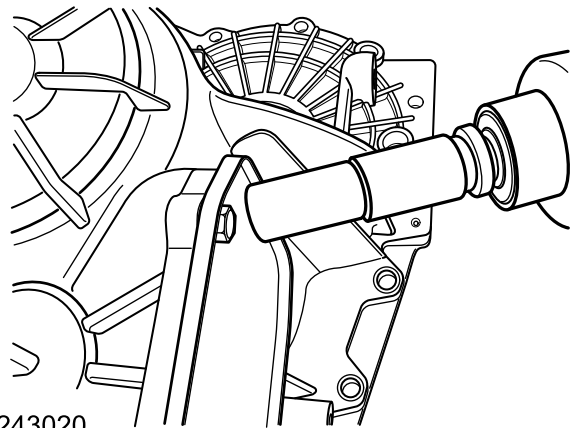
S243034

8. Remove the rear housing cover.



S243035

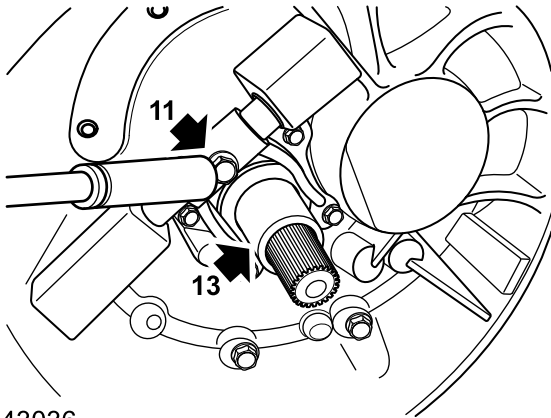
9. Remove the rear housing deck board.



S243020

Caution: There is no need to remove the assembly during the above removals.

10. Remove the release bearing.
11. Remove the screws of release fork.



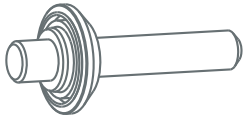
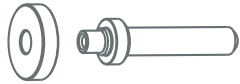
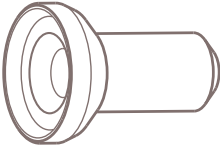


S243036


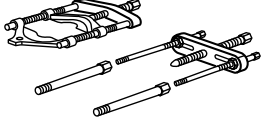



12. Remove the release rocker assembly and release fork assembly.
13. Remove the guide sleeve.

Refit

1. Fit the cylinder bracket and tighten the bolt to **22-30 Nm**.
2. Fit the gear shift bracket and tighten the bolt to **22-30 Nm**.
3. Fit the back-up light switch and tighten it to **32-44 Nm**.
4. Fit the self-locking pin assembly and tighten it to **32-44 Nm**.
5. Fit the refill plug and drain plug and tighten them to **30-40 Nm**.
6. Fit the interlock ring location pin and tighten it to **30-40 Nm**.
7. Fit the handling base assembly and tighten the set bolt to **22-30 Nm**.
8. Fit the rear housing cover.
9. Fit the rear housing deck board and tighten the bolt to **10-14 Nm**.
10. Fit the guide sleeve and tighten the bolt to **10-14 Nm**.
11. Fit the release bearing.
12. Fit the release rocker arm and release fork and tighten the bolt to **30-40 Nm**.






Special Tools

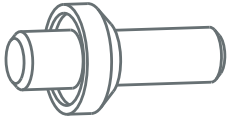



| Tool Number | Description | Picture |
|-------------|---|---|
| T24010 | Driven Shaft Oil Seal Hold-down |  T24010 |
| T24011 | Drive Shaft Front Oil Seal Hold-down |  T24011 |
| T24012 | Cone Bearing Outer Race Hold-down |  T24012 |
| T24013 | 1st/2nd Gear Shift Fork Shaft Bushing Hold-down |  T24013 |
| T24014 | Drive/Driven Shaft Guide Oil Nozzle Hold-down |  T24014 |

| Tool Number | Description | Picture |
|-------------|---|---|
| T24015 | Gear Shift Shaft Needle Roller Bearing Hold-down |  T24015 |
| T32001 | Puller |  T32001 |
| T24001 | Drive Shaft Front Bearing Hold-down |  T24001 |
| T24002 | 4th Gear Needle Roller Bearing Inner Race Hold-down |  T24002 |
| T24003 | Drive Shaft Rear Bearing Hold-down |  T24003 |

Transmission-MT

Transmission

| Tool Number | Description | Picture |
|-------------|---|---|
| T24004 | Drive Shaft Hole Oil Seal Hold-down |  T24004 |
| T24005 | 1st Gear Needle Roller Bearing Inner Race Hold-down |  T24005 |
| T24006 | 2nd Gear Needle Roller Bearing Inner Race Hold-down |  T24006 |
| T24007 | Driven Shaft 4th Gear Hold-down |  T24007 |
| T24008 | Reverse Needle Roller Bearing Inner Race Hold-down |  T24008 |

| Tool Number | Description | Picture |
|-------------|-------------------------------------|---|
| T24009 | Cone Bearing Inner Race Hold-down |  T24009 |
| T24017 | |  T24017 |
| T24024 | Reverse Lock Block Shaft Drift |  T24024 |
| T24016 | Gear Shift Shaft Oil Seal Hold-down |  T24016 |

**Clutch
Specifications
Torque**

| Description | Value |
|--|----------|
| Nut - Master Cylinder to Dash Panel | 19–25 Nm |
| Nut - Master Cylinder and Hard Tube | 15–18 Nm |
| Nut - Slave Cylinder Hose and Slave Cylinder | 15–18 Nm |
| Nut - Slave Cylinder to Manual Transmission Slave Cylinder Bracket | 19–25 Nm |
| Air-bleeder Plug - Clutch Slave Cylinder | 9–15 Nm |

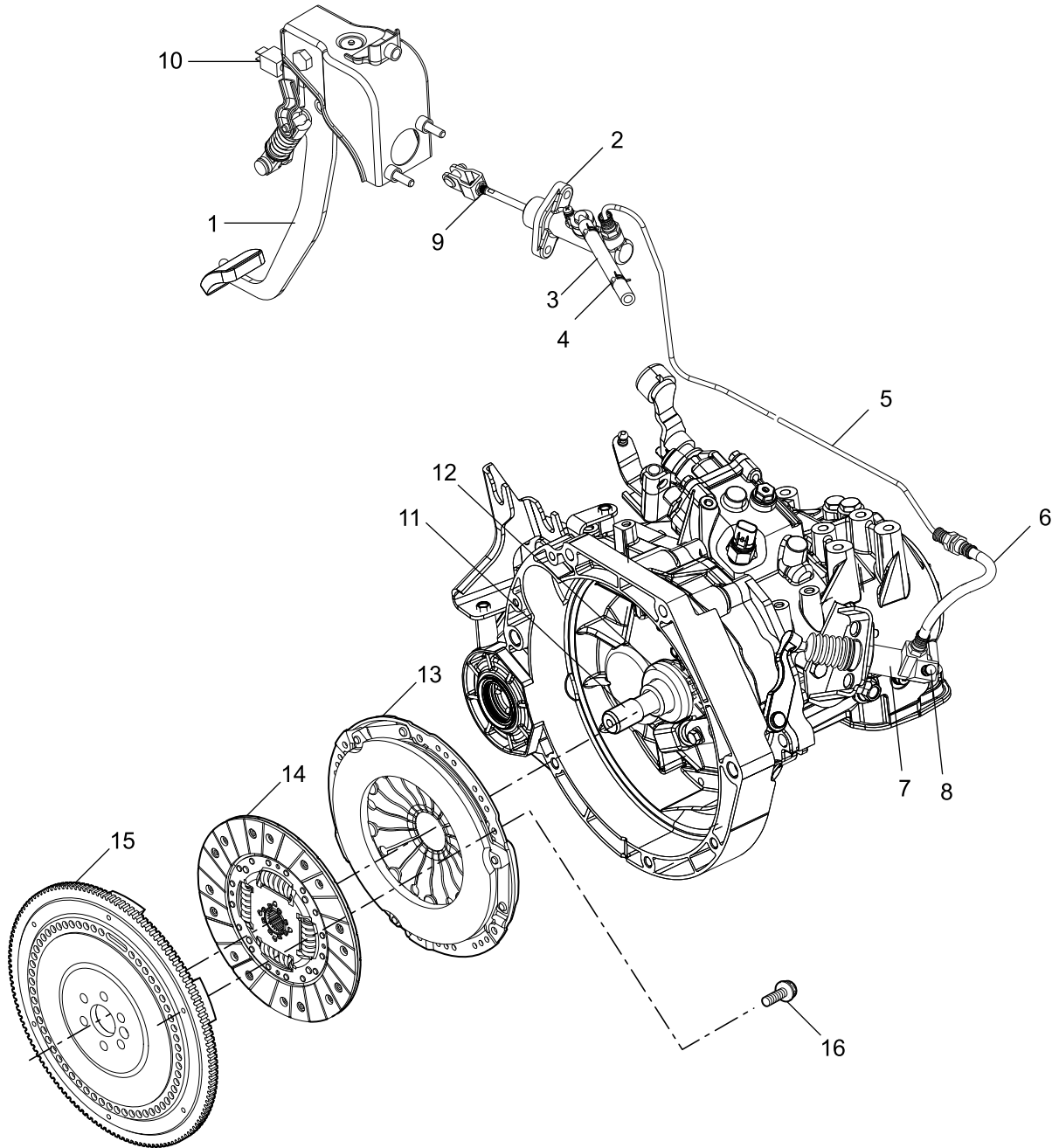
Parameter

| | |
|-------------------------|--|
| Type | Single Plate Dry Type, Hydraulic Booster Type Clutch |
| Driven Disc Diameter | 215 mm |
| Pressure Plate Diameter | 216 mm |
| Rivet Depth: | |
| New | 1.0 m above Rivet Head |
| Service Limit | 0.2 m above Rivet Head |

Description and Operation

System Component Layout

Clutch System



- | | |
|--------------------------------|--|
| 1. Clutch Pedal | 8. Clutch Slave Cylinder Exhaust Valve |
| 2. Master Cylinder | 9. Clutch Pedal Stroke Adjusting Nut |
| 3. Brake Reservoir Hose | 10. Clutch Pedal Switch |
| 4. Clip - Brake Reservoir Hose | 11. Manual Transmission Input Shaft |
| 5. Clutch Hard Tube | 12. Release Bearing |
| 6. Slave Cylinder Hose | 13. Clutch Cover Assembly |
| 7. Slave Cylinder | 14. Driven Disc |
| | 15. Driven Disc |
| | 16. Bolt |

15. Flywheel

16. Bolt (6)

Description

General Description

This is a conventional three-piece diaphragm type clutch with a hydraulic clutch release system which consists of two main parts, a master cylinder and a slave cylinder.

Clutch Hydraulic System

The master cylinder of the clutch is directly fitted on the dash panel of the passenger compartment, and the push rod of the master cylinder piston is secured to the clutch pedal with a pin.

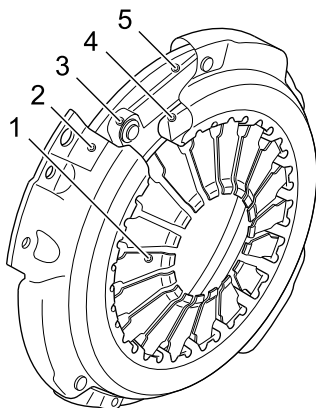
The clutch hard line is connected to the master cylinder with a rotary union, and the other end of the line is connected to the slave cylinder hose with a rotary union as well.

The clutch slave cylinder, which is fitted on the bracket of the manual transmission case, and the release rocker arm, release fork and release bearing form a release mechanism, while the release bearing is supported and secured by a guide sleeve fitted on the transmission input shaft. The release fork positions the release bearing against the diaphragm spring of the clutch when releasing.

Clutch Mechanical System

The model with a manual transmission is equipped with a single mass flywheel. The clutch cover assembly is fitted on the flywheel with location pins and fixed by 6 bolts.

Clutch Cover Assembly



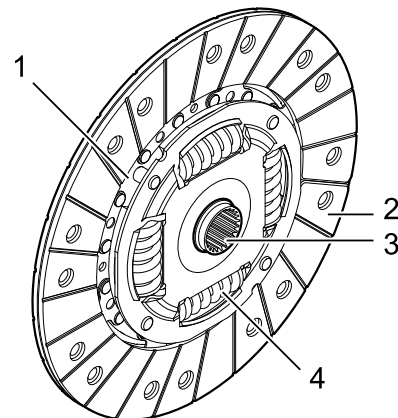
S222002

- 1. Diaphragm Spring
- 2. Clutch Cover
- 3. Pressure Plate
- 4. Support Ring
- 5. Leaf Spring

The clutch cover assembly consists of the diaphragm spring, the pressure plate, and the cover. The pressure plate is made of cast iron and has a machined smooth surface to combine with the driven disc. There are three loops on the outer circle of the pressure plate, then the loops are connected to the housing by springs. The springs are three tempered steel

sheets, which will pull the pressure plate off the driven disc when the clutch pedal is pressed. The clutch housing is made of stamped steel plates. The diaphragm spring is a cast ring, in the inner circle of which there are 18 release fingers. Two circular support rings are fitted on the housing, so that the diaphragm spring can turn between them. The diaphragm spring is not connected to the pressure plate directly. When the release bearing applies pressure to the release fingers of the diaphragm spring, the diaphragm spring will turn around the support rings and leave the pressure plate. At the same time, the springs of the pressure plate connected to the housing leave the driven disc too.

Driven Disc

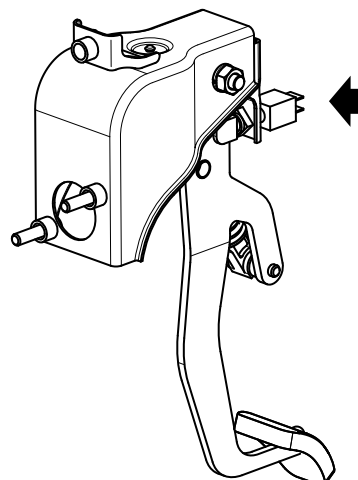


S222003

- 1. Driven Disc Body
- 2. Friction Lining
- 3. Spline Hub
- 4. Torsional Shock Absorber

The driven disc is fitted between the flywheel and the pressure plate, its feature is the spline hub engages with the splines on the input shaft of the transmission. The friction lining consists of two plates, which are riveted on each side of the driven disc body. The rivets are fitted in the holes of the friction lining and holes on the other side to prevent from damaging the pressure plate and the flywheel.

Clutch Switch



The clutch switch is located on the bracket of the clutch pedal, and it is powered by **ECM**.

When the clutch pedal is pressed, the push lever of the switch is released from the pedal arm and ejected by the force of the inner spring, resulting in disconnection of contact points in the switch, at this time, **ECM** receives the clutch release signal; when the clutch pedal returns, the pedal arm is against the push lever of the switch, and overcomes the spring force to close contact points in the switch, **ECM** receives the clutch engage signal.

Operation

Hydraulic Pressure Operation

When the clutch pedal is pressed, the piston is pushed into the master cylinder. The piston makes the fluid in the master cylinder move along the clutch line. The pressure is applied to the slave cylinder piston, which will move under the hydraulic pressure. When the clutch pedal is released, the force of the diaphragm spring release finger pushes the release bearing. The release bearing pushes the piston back to the slave cylinder by the release fork and release rocker arm, then presses the fluid back to the clutch line and the master cylinder.

Mechanical Operation

When the clutch pedal is pressed, the fluid in the slave cylinder pushes the piston to move. The movement of the piston pushes the clutch release bearing towards the release finger of the diaphragm spring by the release rocker arm and the release fork, the diaphragm spring will rotate around the support ring of the pressure plate housing. Along with the deformation of the diaphragm spring, its pressure on the pressure plate disappears. The three leaf springs will pull the pressure plate away from the driven disc.

The disappearance of the pressure that the pressure plate applied to the driven disc reduces the friction between the driven disc and flywheel. The driven disc will slip on the flywheel, the power of the flywheel cannot be transferred to the input shaft of the transmission.

When the clutch pedal is released, the pressure on the piston of the slave cylinder disappears. After that, it makes the release finger of the diaphragm spring push the release bearing to slide along the guide sleeve, which pushes the release fork and the release rocker arm to push the piston of the slave cylinder back to the slave cylinder.

The diaphragm spring rotates around the support ring of the pressure plate housing. Thus, pressure is applied to the pressure plate, and the resistance of the spring is overcome. This pressure makes the pressure plate move towards the flywheel and apply pressure to the driven disc.

The pressure that the pressure plate applies to the driven disc increases the friction between the driven disc and flywheel. After the clutch pedal is released, the friction increases, the rotation of flywheel is transferred to the driven disc, which then transfers the rotation to the input shaft of the transmission.

When the pedal is released completely, the force that the diaphragm spring applies to the pressure plate will press the driven disc on the flywheel, resulting in no sliding between them.

Clutch Switch

When the clutch pedal is pressed, the clutch switch is activated. **ECM** uses signals from the clutch switch for the following functions:

- Reducing shocks during shifting
 - Reducing shocks during shifting to prevent the engine speed from increasing rapidly. Reducing shocks to improve driving performance in the following.
- Smoother shifting
- Better exhaust emission control
- Improved fuel consumption

The clutch switch receives a 12 V reference voltage from **ECM**. When the clutch pedal is in the reset position, the switch is grounded. When the clutch pedal is pressed, **ECM** receives a 12 V signal.

When the clutch switch is malfunctioning, any of the following signs may be seen:

- Reducing shocks is unavailable

Service Procedures

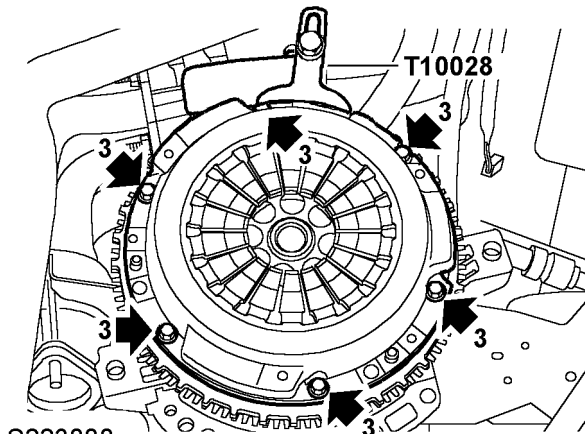
Clutch Assembly

Removal

1. Remove the manual transmission assembly.

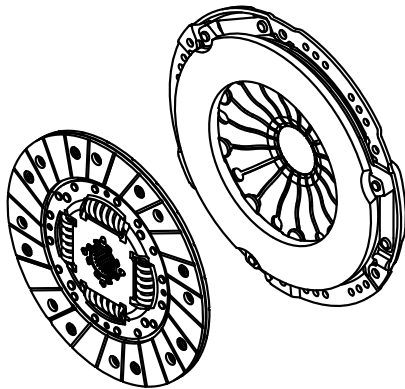
Manual Transmission Assembly Removal

2. Use **T10028** to hold the flywheel.



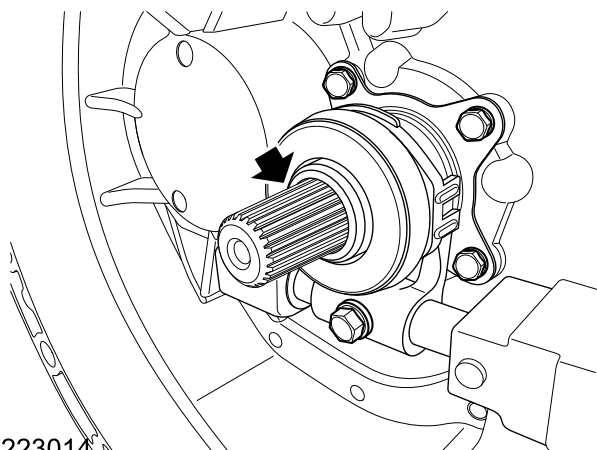
S223000

3. Gradually loosen and remove the 6 bolts securing the clutch cover assembly to the flywheel.
4. Remove the clutch housing assembly and take out the driven disc.



S223002

5. Remove the release bearing.



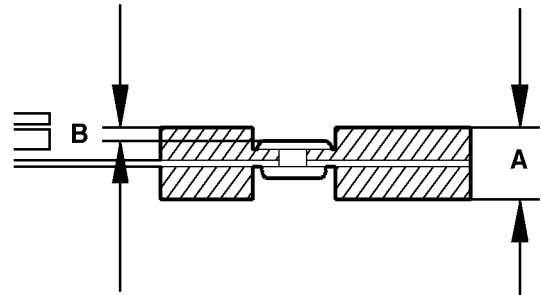
S223014

Inspection

1. Visually check the diaphragm release fingers for wear

or irregular height.

2. Check the driven disc of the clutch for wear or signs of oil contamination. If necessary, replace the driven disc.
3. Measure the thickness of the clutch disc, if it is less than the service limit, replace the driven disc.



S223003

Thickness of the Driven Disc (when it is being compressed) A

| | |
|-----------------|--------|
| New driven disc | 7.2 mm |
| Service limit | 5.7 mm |

4. Measure the depth of the rivet, if it is less than the service limit, replace the driven disc.

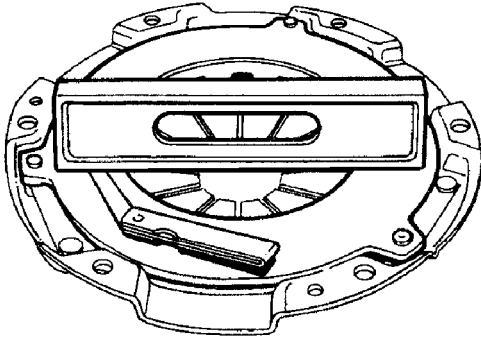
Rivet Depth B

| | |
|-----------------|--------|
| New driven disc | 1.0 mm |
| Service limit | 0.2 mm |

5. Check the pressure plate for wear or signs of damage. Check the drive plate for signs of overheating (dark yellow to blue), if necessary, replace the pressure plate.

Caution: If the clutch pressure plate has been dropped accidentally, it must be replaced. When replacing the worn driven plate, it is advised that the pressure plate should also be replaced.

6. With a straightedge and feeler gauge, check the surface flatness of the pressure plate at 4 separate points. If the deformation stroke is more than the service limit, replace the pressure plate.



S223004

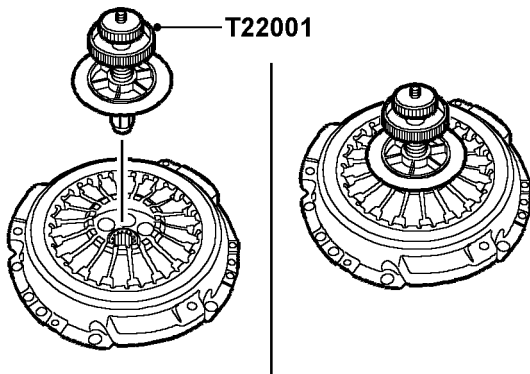
Deformation of Pressure Plate

| | |
|---------------|---------|
| Service limit | 0.15 mm |
|---------------|---------|

7. Check the release bearing for wear or signs of damage, if necessary, replace it.
8. Clean the pressure plate and flywheel, location pin and pin hole.
9. Check the flywheel for signs of scratch or other damage. If there is any wear or damage, replace it.

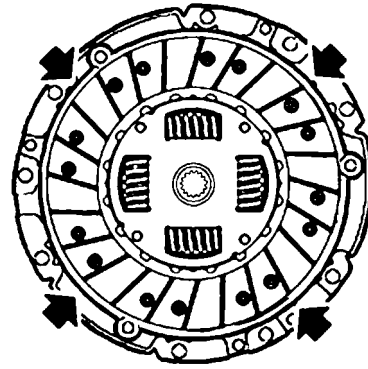
Refit

1. Clean the guide sleeve of the release bearing.
2. Lubricate the guide sleeve of the release bearing with molybdenum disulphide grease.
3. Fit the release bearing.
4. Apply molybdenum disulphide grease to the splines of the clutch driven disc.
5. Be careful about the fitting direction when securing the driven disc to the pressure plate.
6. Use **T22001** to align the driven disc with pressure plate.



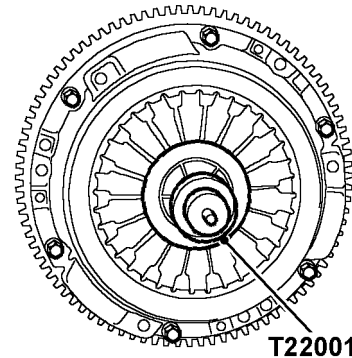
S223006

7. Ensure the driven disc is aligned with the pressure plate centre.



S223007

8. Use **T22001** to fit the clutch assembly to the flywheel.



S223008

9. Fit the 6 bolts securing the pressure plate to the flywheel, and tighten them by hand.
10. Use **T10028** to hold the flywheel, and gradually tighten the bolts to 25 Nm in diagonal order.
11. Remove the driven disc alignment tool **T22001**.
12. Fit the manual transmission assembly.

 **Manual Transmission Assembly Refit**

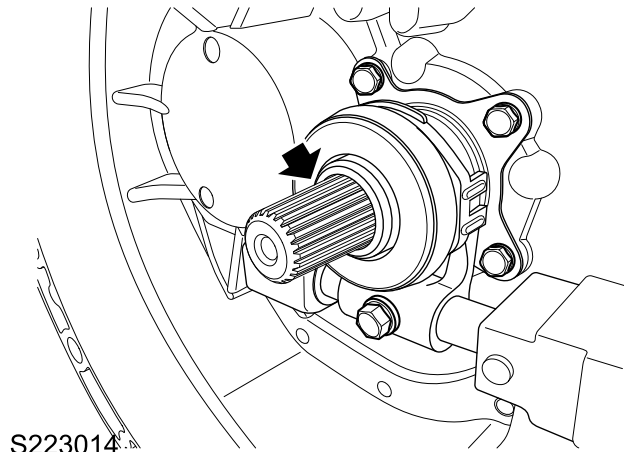
Clutch Release Bearing

Removal

1. Remove the manual transmission assembly.

Manual Transmission Assembly Removal

2. Remove the release bearing from the transmission input shaft guide sleeve.



Refit

1. Clean the mating surfaces between the release bearing and the bearing guide sleeve.
2. Lubricate the bearing moving surface with molybdenum disulphide grease.
3. Set the release bearing on the transmission input shaft guide sleeve, and fit the release bearing to the release fork.
4. Fit the manual transmission assembly.

Manual Transmission Assembly Refit

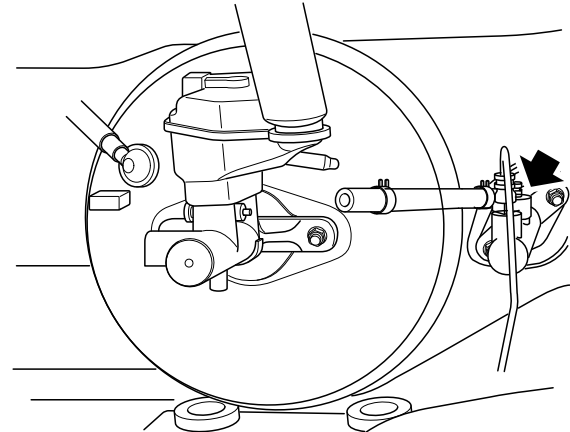
Clutch Master Cylinder

Removal

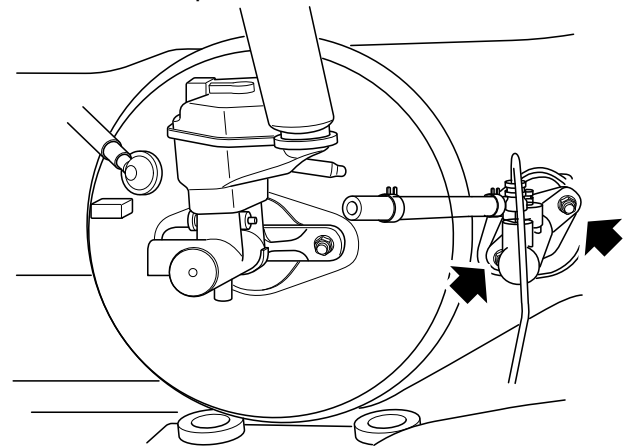
1. Drain the brake fluid from the brake reservoir.

Note: Brake fluid can damage painted surfaces. If brake fluid is accidentally spilled on painted surface when adding it, soak up any spillage with a piece of absorbent cloth immediately and swab the area with water or car cleaner.

2. Disconnect the brake reservoir hose and the reservoir tank.



3. Disconnect the master cylinder and the EVP pipe.
4. Remove the driver side sealed panel assembly.
5. Release the pin and the master cylinder push lever of the clutch pedal.



6. Remove the 2 nuts securing the clutch master cylinder to the dash panel and remove the master cylinder.

Refit

1. Position the master cylinder on the dash panel, fit the nuts and tighten them to **19–25 Nm**.
2. Apply grease to the inside of the clutch pedal pin hole, hold the master cylinder push lever to the clutch pedal and fix it with a pin.
3. Connect the master cylinder with the EVP pipe and tighten to **15–18 Nm**.
4. Fit the driver side sealed panel assembly.
5. Connect the brake reservoir hose with the reservoir

tank.

- Bleed the clutch line system.

Clutch Line System Bleeding

- Add brake fluid into the reservoir tank to the MAX line.

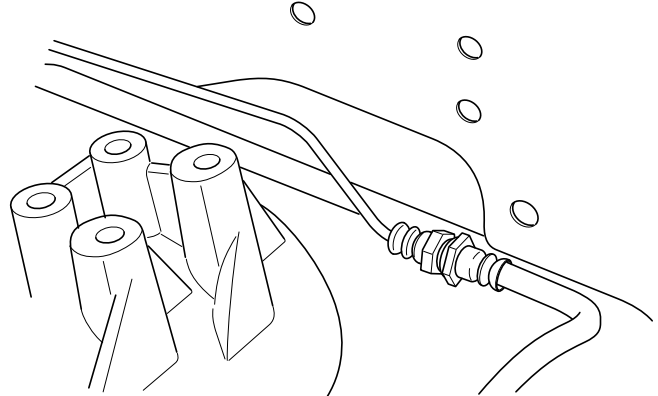
Clutch Slave Cylinder

Removal

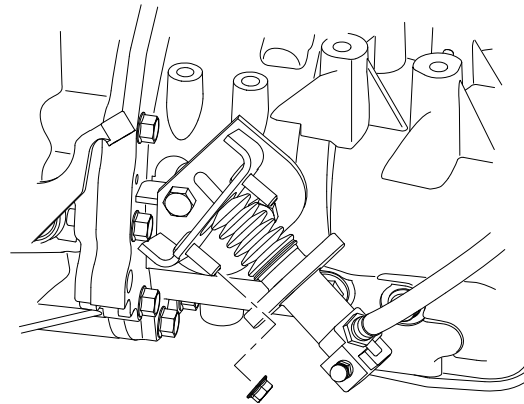
- Drain the brake fluid from the brake reservoir.

Note: Brake fluid can damage painted surfaces. If brake fluid is accidentally spilled on painted surface when adding it, soak up any spillage with a piece of absorbent cloth immediately and swab the area with water or car cleaner.

- Disconnect the slave cylinder and the slave cylinder hose.



- Loosen the 2 nuts securing the slave cylinder to the slave cylinder bracket of the manual transmission.



S223017

- Remove the slave cylinder.

Refit

- Connect the slave cylinder and the slave cylinder hose and tighten to **15–18 Nm**.
- Push the end of the slave cylinder push lever against the base hole of the release rocker arm.
- Secure the slave cylinder to the slave cylinder bracket of the manual transmission and tighten the nut to **19–25 Nm**.
- Bleed the clutch line system.

Clutch Line System Bleeding

- Add brake fluid into the reservoir tank to the MAX line.

Clutch Line System Bleeding

Bleeding

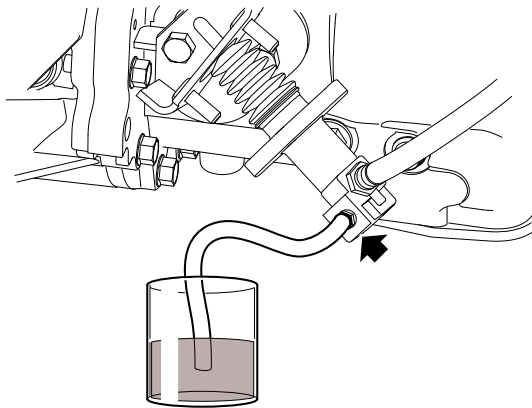
Bleed the air entering the hydraulic system when disconnecting the line to repair. When bleeding, the brake fluid in the brake reservoir must be kept at the MIN line or above.

Warning: *DO NOT allow the brake fluid to contact your eyes or skin.*

Caution: *Never reuse the brake fluid that has been bled from the clutch line system.*

Caution: *Ensure the level of new brake fluid in the brake reservoir is between the MIN and MAX throughout the whole bleed procedures.*

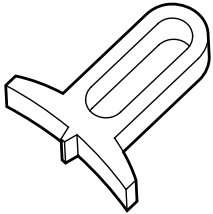
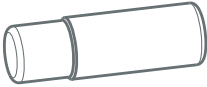
1. Raise the vehicle on the lift.



S223018

2. Remove the air-bleeder plug dust cover from the slave cylinder of the clutch, and fit the hose to the air-bleeder plug. Submerge the free end of the hose into a glass container half full of new brake fluid.
3. Fully press the clutch pedal and hold it to ensure the maximum system pressure.
4. Loosen the air-bleeder plug to bleed the air in the fluid, the system pressure decreases at this time.
5. First tighten the air-bleeder plug to prevent back flow of fluid and air.
6. Smoothly release the clutch pedal to the maximum stroke, make it return without any external force to supplement brake fluid sufficiently.
7. Operate several times in the above order until brake fluid without any air flows into the container, then keep the clutch pedal in the maximum stroke position, and tighten the air-bleeder plug to **9–15 Nm**.
8. Remove the hose from the air-bleeder plug, and fit the air-bleeder plug dust cover.
9. Add brake fluid into the reservoir tank to the MAX line.

Special Tools

| Tool Number | Description | Picture |
|-------------|-----------------------|---|
| T10028 | Flywheel Locking Tool |  <p>T10028</p> |
| T22001 | Clutch Aligner |  <p>T22001</p> |

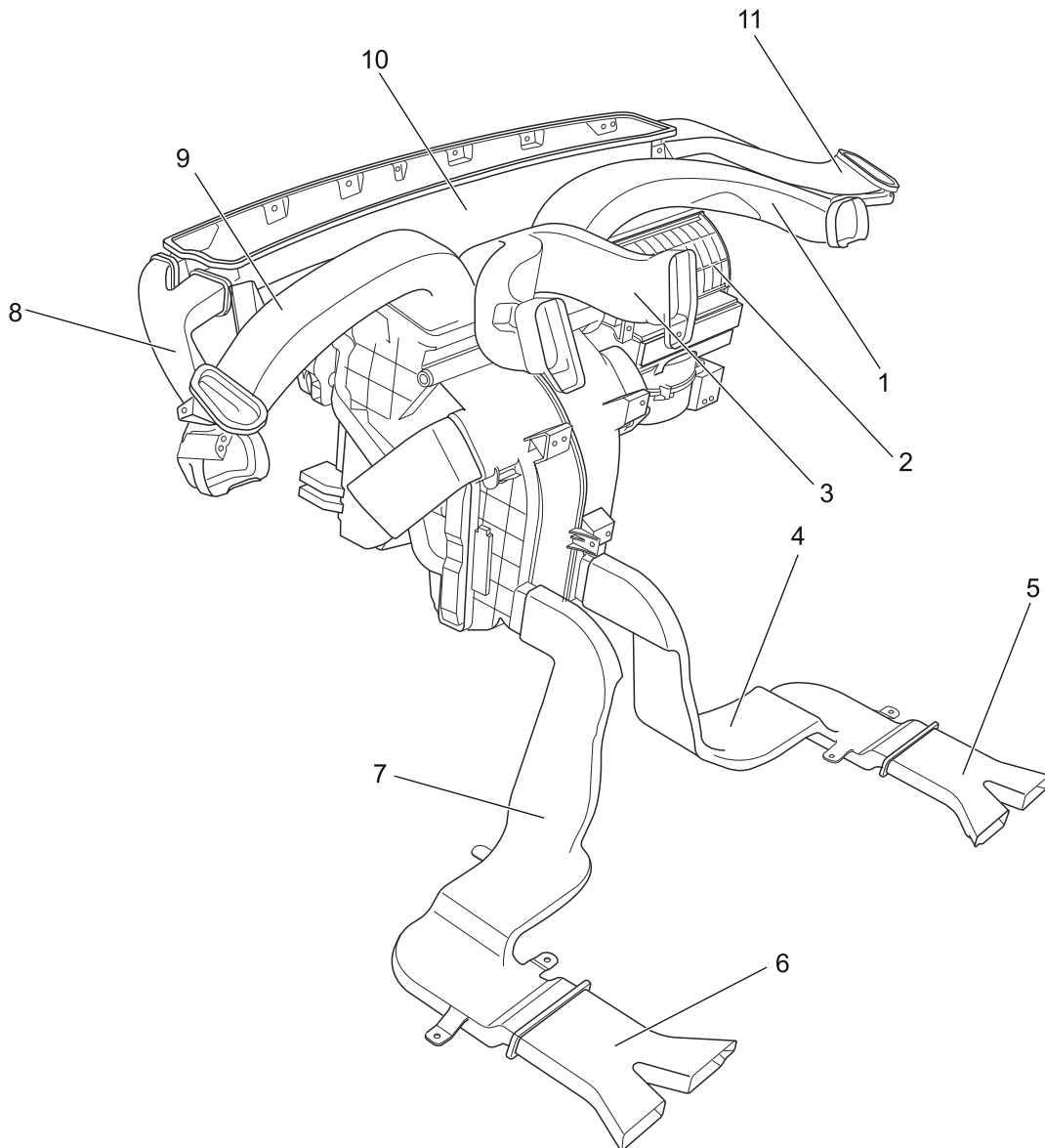
HVAC Structure**Specifications****Torque**

| Description | Value |
|--|------------|
| Screw - A/C Compressor to Oil Pan | 19-25 Nm |
| Bolt - Air Conditioning Tube to Compressor | 19-25 Nm |
| Bolt - Air Conditioning Tube to White Body | 7-10 Nm |
| Bolt - Condenser to Radiator | 5.5-7.5 Nm |
| Screw - Air Conditioning Tube to Condenser | 7-10 Nm |
| Bolt - HVAC Module | 3-4 Nm |
| Nut - Air Conditioning Tube to Expansion Valve | 19-25 Nm |
| Bolt - TXV to Evaporator Core | 4-6 Nm |
| Nut - Air Conditioner EVP Pipe Assembly Mounting Bracket | 7-10 Nm |
| Screw - Floor Duct LH to Body | 4-6 Nm |
| Screw - Floor Duct RH to Body | 4-6 Nm |
| Screw - Floor Outlet LH to Body | 4-6 Nm |
| Screw - Floor Outlet RH to Body | 4-6 Nm |

Parameter

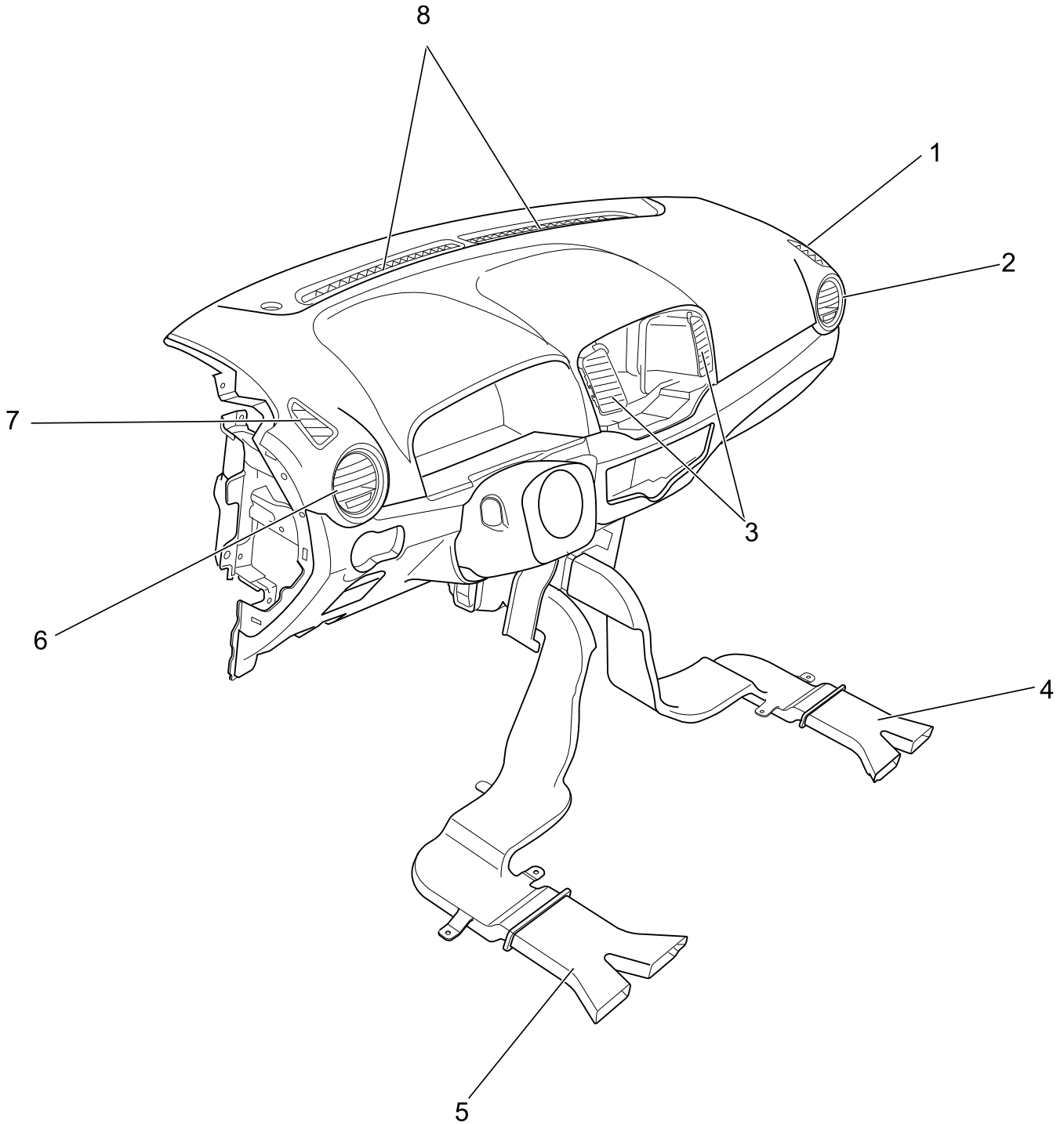
| | |
|---|--|
| Model | Non-CFC, closed loop system, controlled by A/C ECU |
| Refrigerant Type | HFC-R134a |
| Refrigerant Charge Volume | 550 g |
| Compressor: (25°C-40°C) <ul style="list-style-type: none"> • Pressure on high pressure side • Pressure on low pressure side | 1.05-2.53 MPa 0.1-0.3 MPa |
| Displacement | 167 ml/r |
| Lubricant | PAG46 |
| Fill Volume (new) | 140±10 ml |
| Evaporator Temperature Sensor: <ul style="list-style-type: none"> • Compressor ON • Compressor OFF | +3.5°C -5.5°C |
| Pressure Switch: Low-pressure Protection: <ul style="list-style-type: none"> • Turn off the pressure • Turn on the pressure High-pressure protection: <ul style="list-style-type: none"> • Turn on the pressure • Turn off the pressure Cooling Fan Control: High Speed: <ul style="list-style-type: none"> • Turn off the pressure • Turn on the pressure | 0.196 MPa 0.226 MPa 2.54 MPa 3.14 MPa 1.37 MPa 1.77 MPa |

Description and Operation
System Component Layout
Heater and Ventilation System



- | | |
|---|---|
| 1. Instrument Panel Vent Piping - Right | 7. Rear Seat Foot Duct - Left |
| 2. Internal Circulation Inlet | 8. Front Side Window Vent Piping - Left |
| 3. Instrument Panel Vent Piping - Face | 9. Instrument Panel Vent Piping - Left |
| 4. Rear Seat Foot Duct - Right | 10. Front Windshield Vent Piping |
| 5. Rear Seat Foot Duct Outlet - Right | 11. Front Side Window Vent Piping - Right |
| 6. Rear Seat Foot Duct Outlet - Left | |

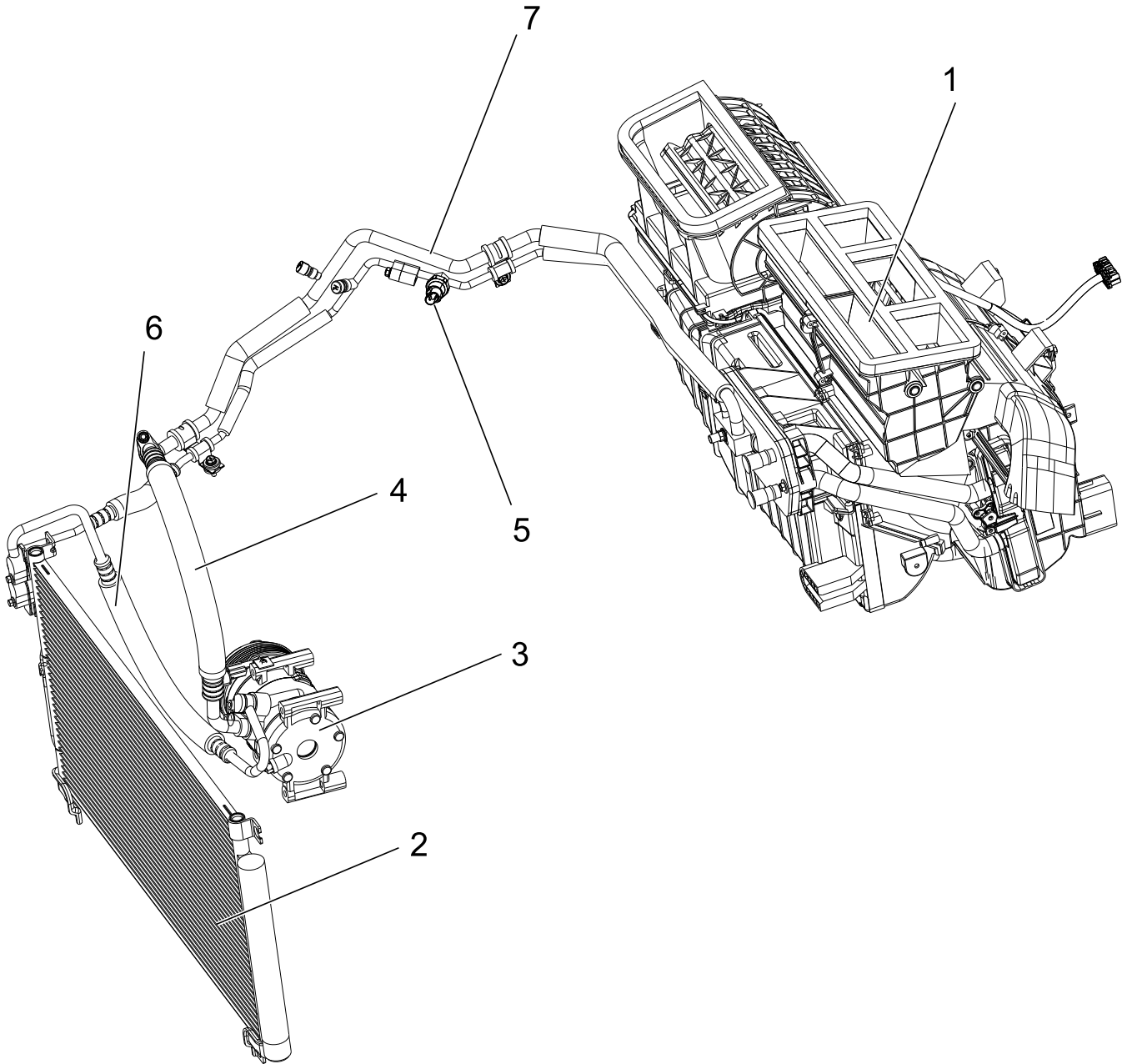
Temperature and Air Volume Distribution Control



- 1. Front Side Window Vent - Right
- 2. Instrument Panel Vent - Right
- 3. Instrument Panel Vent - Centre
- 4. Rear Seat Foot Vent - Right

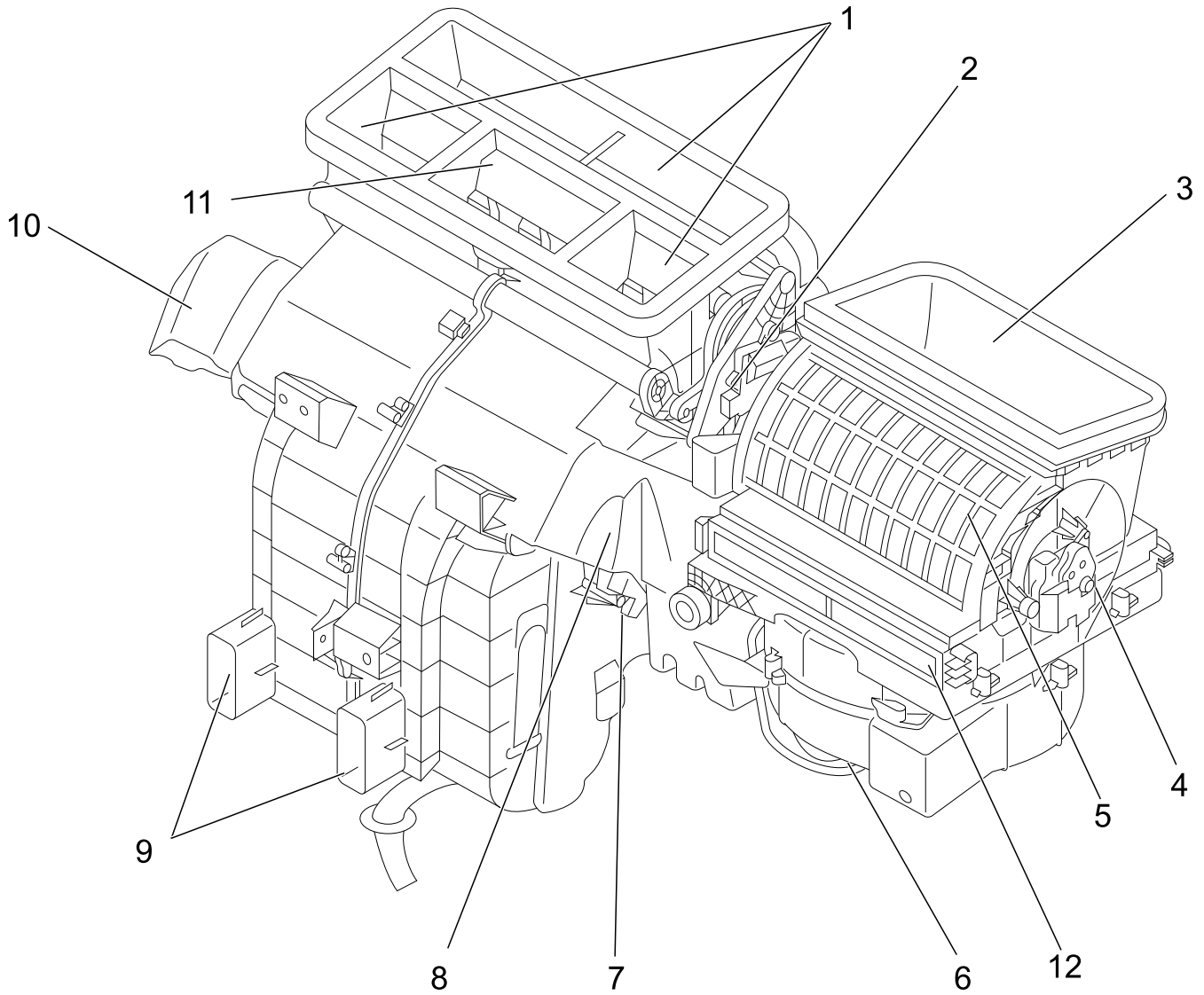
- 5. Rear Seat Foot Vent - Left
- 6. Instrument Panel Vent - Left
- 7. Front Side Window Vent - Left
- 8. Front Windshield Vent

Air Conditioning (A/C) Refrigeration System



- 1. HVAC Module Assembly
- 2. Condenser
- 3. Compressor
- 4. Compressor Suction Hose
- 5. Air Conditioning Pressure Switch
- 6. Compressor Exhaust Hose
- 7. EVP Pipe Assembly

HVAC Module Assembly



- 1. Front Windshield and Front Side Window Vent
- 2. Mode Damper Mechanism and Servomotor
- 3. Fresh Air Inlet
- 4. Air Recirculation Control Damper Mechanism and Servomotor
- 5. Recirculated Air Inlet
- 6. Blower

- 7. Mix Damper Mechanism and Servomotor
- 8. Front Seat Foot Vent - Right
- 9. Rear Seat Foot Vent
- 10. Front Seat Foot Vent - Left
- 11. Front Seat Face Vent
- 12. Air Conditioning Filter

Description

General Description

Heating, ventilation and air conditioning system controls the air temperature and distribution inside the vehicle. The system includes: compressor, air conditioning tube, condenser, HVAC module assembly, duct and controller assembly.

Air enters the HVAC module assembly through the outer recirculation or inner recirculation inlet, and passes through the whole system blown by the blower. Depending on the setting of the control panel, the air is heated or cooled and then supplied to the front windshield, instrument panel and foot vent through the distribution duct.

Electronic air conditioning system (**ETC**) or automatic air conditioning system (**ATC**), one of the two types of air conditioning system, is fitted on the vehicle depending on the models:

- In the electronic controlled air conditioning system, functions can be selected manually, such as air recirculation, air temperature, air distribution and blower speed and so on.
- Automatic air conditioning system monitors and adjusts the temperature, blower speed and air distribution automatically. Automatic mode provides the optimum system control and does not need manual interference. Manual mode allows to ignore the automatic operation of individual function, to adapt to personal preference.

Both the systems consist of the refrigeration system, HVAC module assembly and control system. **ATC** differs from **ETC** in that **ATC** has additional solar sensor, room temperature sensor and heater core coolant temperature sensor, and the air conditioner controller assembly is also different from that of the **ETC**.

Air Conditioning Filter

Air conditioning filter is located over the HVAC module blower, and used to improve the fresh air quality supplied to the interior of the vehicle.

HVAC Module Assembly

HVAC module assembly heats and distributes the fresh air or recirculated air based on the selected mode in control panel. HVAC module assembly, which is fitted between the instrument panel and engine compartment dash panel, contains blower, air conditioning filter, heater core, evaporator core and control damper in the case. The passage in HVAC module assembly guides the air through the case and divides it into two parts, one part enters the vent LH, and the other part enters the vent RH. The vent on the bottom of the case guides the condensed water to the underneath of the vehicle from the interior of the case. A wire harness on HVAC module assembly connects with the entire vehicle wire harness.

HVAC module assembly controls the air distribution and air temperature.

- **TXV**, evaporator and evaporator temperature sensor
- Servomotor, handles each control damper respectively. There are 3 servomotors in the system to handle the mode damper, mix damper and air recirculation control damper. Servomotors are fitted on the outside of the case, and controlled by the air conditioner controller. Feedback voltmeter in each servomotor provides the relevant damper position signals to the air conditioner controller.
- Heater core temperature sensor is fitted on the bottom of the heater core, and outputs temperature signals to **ATCECU** (only for **ATC**).
- Blower governor resistor is used for controlling the blower speed.

Blower

Blower, fitted on the right side of the heater core, consists of the motor and fan. The operation of the blower is realized through controlling the blower governor resistor on the HVAC module assembly by the governor knob on the control panel.

Heater Core

Heater core is used to heat the air inside the vehicle. Heater core is an aluminum one-way, flat tube heat exchanger, mounted in the HVAC module assembly. The HVAC module assembly and engine cooling system are connected by two aluminium tubes through the engine compartment dash panel. When the engine is running, the coolant flows through heater core continuously driven by the coolant pump.

Air Circulation Control Damper

Air circulation control damper controls the air circulation mode by opening and closing the fresh air and recirculated air inlets. The servomotor drive damper is controlled by the air recirculation control switch on the control panel.

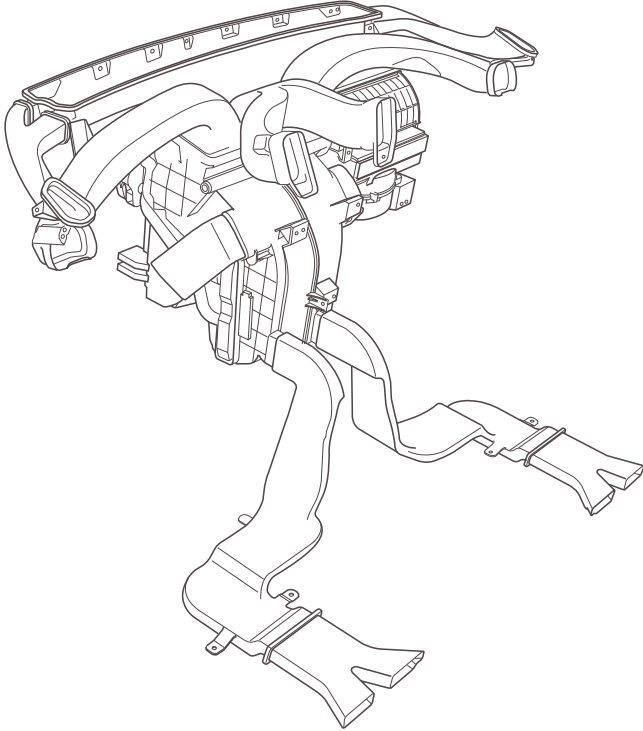
Mix Damper

Mix damper controls the air temperature in the HVAC module assembly by adjusting the airflow passing through the heater core. Mix damper is controlled by the mix damper servomotor.

Air Distribution Damper

Air distribution damper is used to control the airflow from the foot, front windshield/front side window and face vents. These dampers control the airflow volume from mix damper to vent. Air distribution damper is controlled by the mode servomotor fitted on the HVAC module.

Air Distribution Duct



The face vents of the rear seat foot and instrument panel are equipped with individual air distribution ducts. Air distribution ducts for the front windshield and front side window are integrated in the instrument panel. Rear seat foot passage is

connected to the port on the HVAC module assembly face, and extends along the floor under the front seat.

Vent assembly in the instrument panel makes it possible for the passenger to control the volume and direction of the air that blows to the face. Each vent assembly is integrated with a thumb wheel for flow adjustment and removable vanes for direction control.

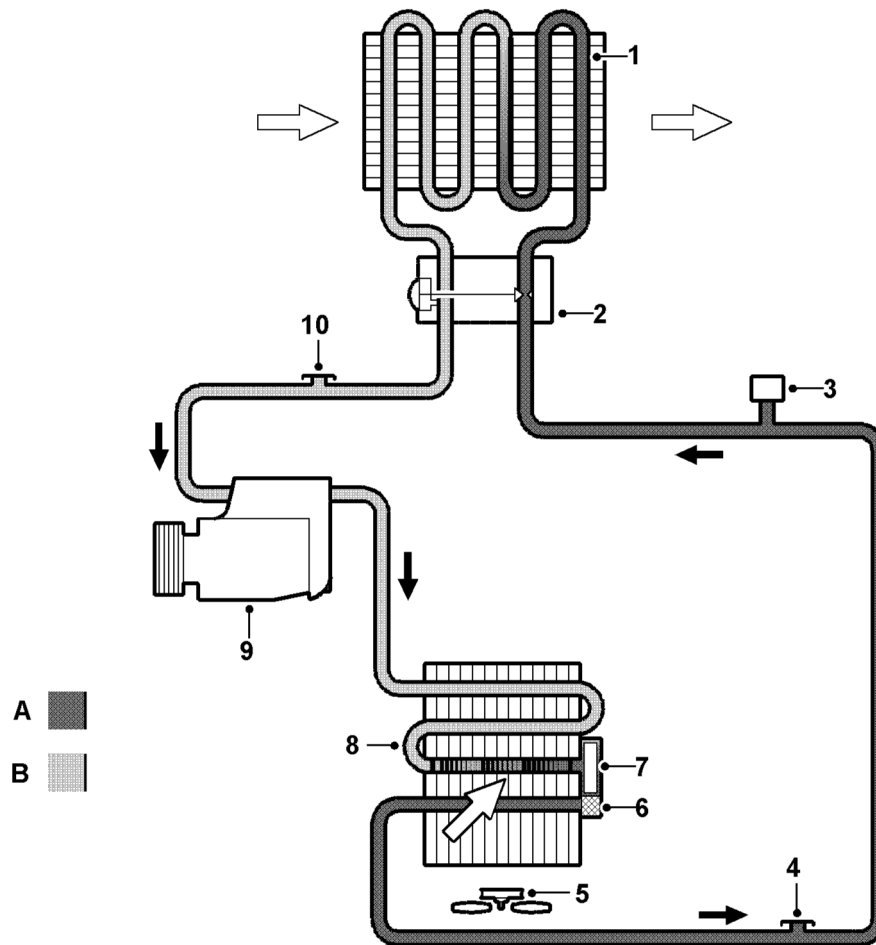
Front seat foot vent is attached to the port on the side of the HVAC module assembly side. The two rear floor vents (located under the front seat) distribute the air to the rear floor area.

Vent

The vents facilitate the warm air and vent air to flow through the passenger compartment smoothly. The vents which are located on the left side and right side of the boot allow the air in the passenger compartment to be discharged to the hidden areas between the body and rear bumper. The vents are check valve structure, and each vent consists of grilles covered by the soft rubber damper. The damper can be opened and closed automatically according to the pressure difference between the passenger compartment and outside.

Refrigeration system

Air Conditioning System Schematic Drawing



S462006

A = Liquid Refrigerant; B = Vapor Refrigerant

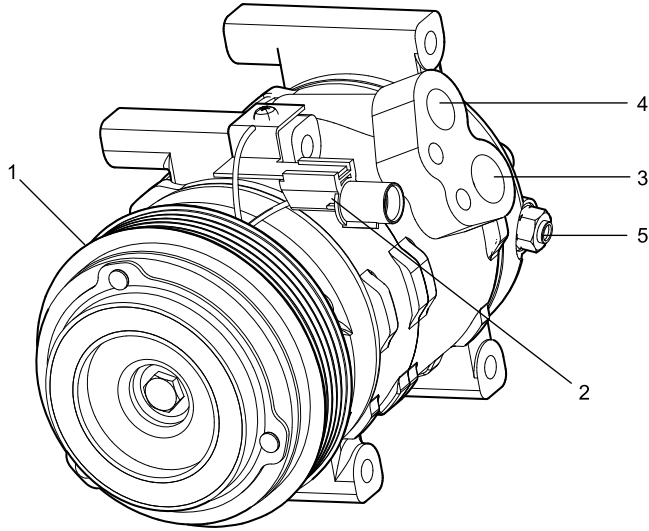
- | | |
|-------------------------------------|------------------------------------|
| 1. Evaporator | 6. Filter |
| 2. TXV | 7. Desiccant |
| 3. Air Conditioning Pressure Switch | 8. Condenser |
| 4. High Pressure Service Connector | 9. A/C Compressor |
| 5. Cooling Fan | 10. Low Pressure Service Connector |

The refrigeration system transmits the heat inside the vehicle to the outer atmosphere in order to provide cool air without the humidity for the HVAC module assembly. The system consists of the compressor, condenser, **TXV**, conditioning tube and evaporator. It is a closed circuit with the R134a refrigerant as the heat-transfer medium. Air conditioner lubricant is added to the refrigerant to lubricate the internal sets of the compressor.

To complete the heat transmission and the refrigerant recirculation around the system, the refrigerant goes through two kinds of pressure/temperature modes within the system. In each pressure/temperature mode, the refrigerant changes its state and absorbs and releases the maximum heat during

the change of its condition. Low pressure/low temperature mode starts from the **TXV**, through the evaporator to the compressor, and in the **TXV**, the refrigerant reduces the pressure and temperature, then changes its state in the evaporator from moderate temperature liquid to low temperature steam to absorb the heat of the air passing the evaporator. High pressure/high temperature mode starts from the compressor, through the condenser to the **TXV**, and the refrigerant increases the pressure and temperature when passing the compressor, then it releases the heat in the condenser to the atmosphere and changes its state from high temperature steam to moderate liquid.

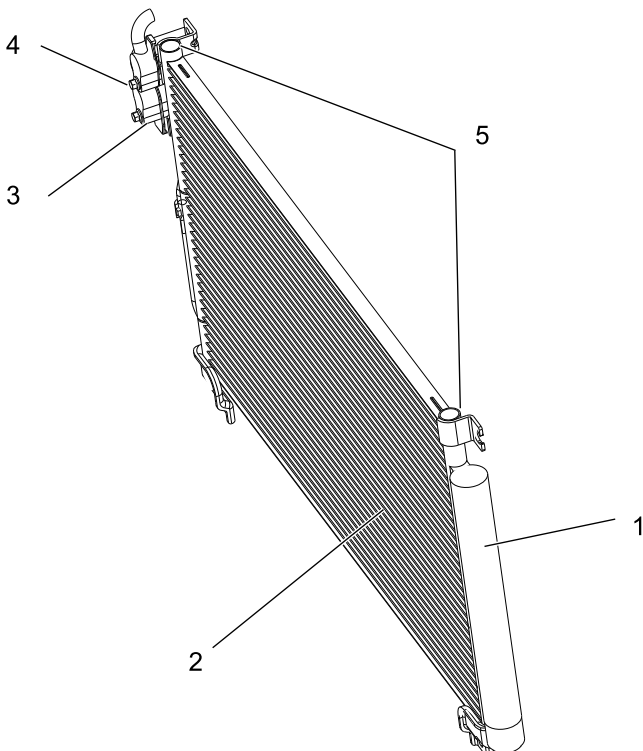
Compressor



1. Pulley
2. Magnetic Clutch Connector
3. Inlet Port
4. Outlet Port
5. Control Pressure Relief Hole

The compressor with a constant displacement is fitted on the engine mounting bracket. The compressor is driven by the magnetic clutch and pulley. The compressor circulates the refrigerant around the system by compressing the low pressure and low temperature steam from the evaporator and converting it into the high pressure and high temperature steam to the condenser.

Condenser



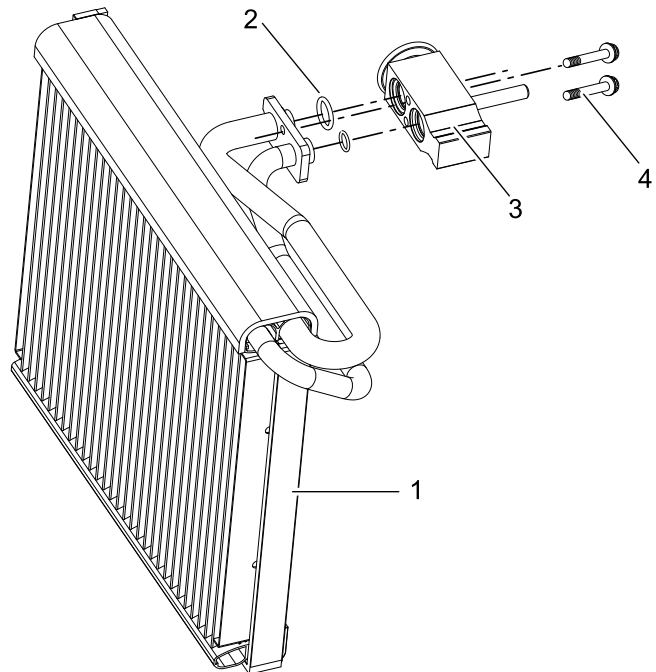
1. Adjusting Chamber
2. Heat Exchanger
3. Outlet Port
4. Inlet Port
5. End Chamber

The condenser transmits the refrigerant heat to the ambient air in order to convert the refrigerant steam from the compressor into liquid. Meanwhile the condenser also removes the moisture and solid particles in the refrigerant with the drying module and serves as the container of the refrigerant to adapt to the changes of the heating load in the refrigerant.

Due to the function of the impact effect and/or cooling fan, the refrigerant is converted into liquid with its heat absorbed by the air in the heat exchanger. Before the refrigerant enters the adjusting chamber, the condenser cools and liquefies the refrigerant. In the adjusting chamber, most of the remaining air in the refrigerant is separated and the refrigerant goes through the desiccant and filter to remove the moisture and solid particles in it, then enters the secondary cooler. The refrigerant is cooled further when it flows through the secondary cooler. Therefore, almost 100% of the refrigerant from the condenser outlet to the evaporator converts into the liquid state.

Expansion Valve (TXV)

TXV and Evaporator

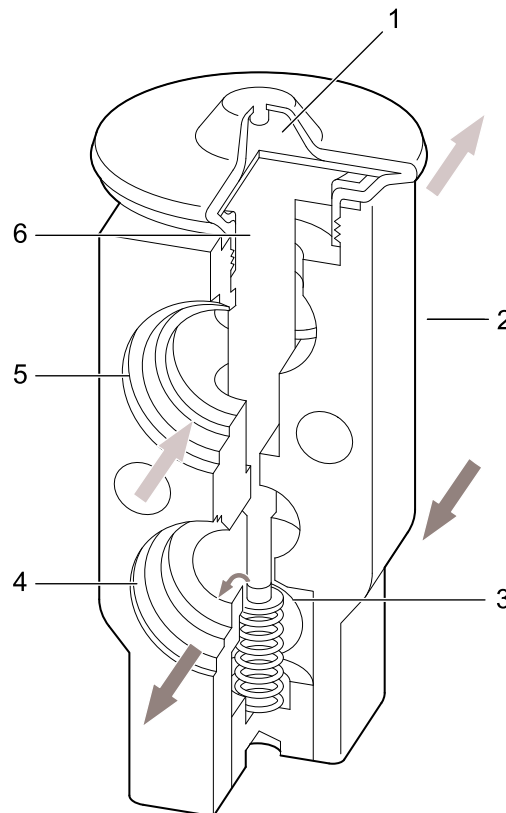


1. Evaporator
2. O-ring
3. TXV
4. Bolt

The expansion valve can adjust the refrigerant flow volume to make it match with the air heating load passing the evaporator core. The expansion valve is fitted on the inlet port and outlet port of the evaporator. This valve has an aluminum casing which has inlet and outlet passages inside. The metering valve is fitted in the inlet passage which is controlled by the thermistor pipe connected to the diaphragm. The diaphragm of which the top is filled with refrigerant can sense

the evaporator outlet pressure while the thermistor pipe senses the evaporator outlet temperature. By adjusting the thermostatic expansion valve opening, the applied force can be balanced, the proper overheating extent at the evaporator outlet can be ensured and the balance between the refrigerant amount and the air heating load can be achieved.

Thermostatic Expansion Valve



S462011

- 1. Diaphragm
- 2. Casing
- 3. Metering Valve

- 4. to Evaporator Inlet Passage
- 5. from Evaporator Outlet Passage
- 6. Thermistor Pipe

Liquid refrigerant flows through the metering valve and enters the evaporator. The pressure and temperature of the refrigerant are reduced by the limit of the metering valve, and at the same time the refrigerant is changed from solid to fine spraying jet to improve the evaporation effect. When passing through the evaporator, the refrigerant absorbs the air heat passing around the evaporator core, and the increase of the temperature will evaporate the refrigerant and increase the pressure of the refrigerant.

the refrigerant, so as to allow more refrigerant to pass through the metering valve.

Evaporator

Evaporator is fitted in the HVAC module assembly, and used to absorb the heat from outer intake or recirculation intake. The refrigerant with low pressure and temperature changes from liquid to steam in the evaporator, and it will absorb a lot amount of heat during this change.

Air Conditioning Tube

Each component of the system is connected by the aluminum air conditioning tube, and to ensure the sealing reliability, there is an O-ring between each interface. To maintain the similar flow speed of the system, the diameter of the air conditioning tubes may be different to adapt to the two

kinds of pressure/temperature conditions. A tube with larger diameter is fitted in the condition of low pressure/low temperature, smaller diameter in the condition of high

pressure/high temperature, and the refrigerant fill port is integrated in the air conditioning tube for system service.

**Operation
Compressor**

When the engine is running and the air conditioner is off, magnetic clutch shuts down, the pulley and drive belt rotate with inertia.

When the air conditioner is requested to use, the magnetic clutch is on, the pulley and shaft move together by the effect of the sucking disc. The trailing bar and swash cam rotate with the shaft together, the angled swash cam makes the piston move back and forth. Steam in the air intake pressure chamber is sucked in block and discharged into the air exhaust pressure chamber after being compressed, and airflow is produced in the refrigerating circuit.

Compressor Clutch Relay

12V power supply supplies power to the air conditioner compressor clutch through the No.10 relay in the engine compartment fuse box. When the main relay is on, the air conditioner clutch relay coil can be activated. The relay coil ground is controlled by **ECM**, and it is completed after receiving the air conditioner on request information.

Malfunction

If the air conditioner compressor clutch relay is malfunctioning, the following will be seen:

- Clutch does not engage with compressor pulley (visually check)
- Inlet temperature does not decrease

The following malfunctions may occur in the air conditioner compressor clutch relay:

- Relay coil short
- Relay coil open
- High relay coil resistance
- Relay contact point remains open
- Relay contact point remains close
- High relay contact point resistance
- Relay wire open
- High relay wire resistance
- Relay wire short to 12V power supply
- Power supply short
- Relay wire short to ground
- **ECM** does not provide ground

If the air conditioner compressor clutch is not engaged, but the air conditioner switch is on "ON" position, remove the compressor clutch relay and perform the test.

Air Conditioning Pressure Switch

Warning: Service can be carried out only by the personnel who is familiar with both the vehicle system and the charging and testing equipment. All operations must be carried out in the area with good air ventilation and away from open flame and heat source.

The pressure switch can be used to perform the following operations:

1. If the refrigerant pressure reaches the specified value, it will engage the air conditioner compressor clutch.
2. If the refrigerant pressure is lower or higher than the specified value, it will disengage the air conditioner compressor clutch.
3. If the refrigerant pressure is higher than the specified value, it will turn on or off the cooling fan and adjust the fan speed according to the pressure value.

| Compressor Condition | Opening Pressure, MPa | Closing Pressure, MPa |
|----------------------|-----------------------|-----------------------|
| Low Pressure | 0.226 | 0.196 |
| High Pressure | 2.54 | 3.14 |

As a result, if the air conditioner pressure is lower or higher than any threshold value of the closing pressure, the ground route of **ECM** will be disconnected. This may result in the disengagement of air conditioner compressor clutch by **ECM** strategy.

As the compressor is lubricated by lubricant oil suspended in refrigerant, if the minimum refrigerant pressure in the system results in the minimum refrigerant and lubricant, the compressor operation should be stopped.

When additional condensation is required as the refrigerant pressure increases, **ECM** makes the cooling fan relay unit ground, to get the corresponding cooling fan speed.

Malfunction

If the sensor is malfunctioning, the driver may discover that the air conditioning system does not operate or stops after operating for a while.

The followings may occur to the sensor:

- Low refrigerant pressure caused by refrigerant leakage or wrong refrigerant filling
- High refrigerant pressure caused by wrong refrigerant filling
- Inner circuit short
- Outer circuit open
- Outer circuit short to 12V power supply
- Sensor has no ground

Cooling Fan Control

ECM operates the cooling fan relay unit to control the engine cooling fan speed: high speed and low speed. When the ignition switch is turned on, **ECM** makes the main relay in the engine compartment fuse box on, to supply the battery power to the cooling fan relay unit through fuse I3. After the contact point of the cooling fan relay coil is closed, the battery power is supplied to the cooling fan motor through fusible link I3. **ECM** turns on or turns off the two relays in the cooling fan module to control the power supply.

The cooling fan could also be used to cool the engine coolant and automatic transmission case oil in addition to the refrigeration system (if equipped). When there is a conflict between the fan speeds required for different systems, select the higher speed.

When the compressor request is permitted, **ECM** controls the cooling fan relay unit based on the pressure signal feedback from the air conditioning pressure switch, to operate the cooling fan at low or high speed, to ensure the proper cooling for the condenser.

Air Temperature Control

To determine the heating capacity or cooling capacity required in the passenger compartment, **ATCECU** uses the sensor

input temperature and selected temperature on the control panel to calculate the target temperature of the vent on the heater assembly driver side and front passenger side. Then, **ATCECU** sends signals to the servomotors for them to control the mix damper on the heater assembly, and move the damper to the appropriate position. The target temperature updates continuously, and is used in the further calculations to determine the blower speed and air distribution in the automatic mode.

The average temperature in the passenger compartment is adjusted according to the ambient temperature. If the air temperature around is too low, increase the average temperature in the room. If the air temperature around is too high, increase the average temperature in the room slowly.

The signal provided by the solar sensor is served as the compensation for the control algorithm, to allow the passenger compartment reach the comfortable temperature even if the sunshine loads. Compensation is effective only when the air distribution is set to the face position or face/foot position, as passengers could feel the compensation in these places.

Service Procedures

Recovery and Refilling of Refrigerant

Life and work efficiency for the air conditioning (A/C) system depend on the chemical stability of the refrigeration system. When the refrigeration system is contaminated by foreign matters (such as dust, air or moisture), the stability of the refrigerant and polyether type (PAG) air conditioning lubricant will be changed by contaminant. Contaminant could also affect the relations between pressure and temperature, reduce work efficiency, and result in internal corrosion and abnormal wear of moving parts.

Ensure the chemical stability of the system in the following manners:

- Wipe the dust and oil on or around the fitting before opening it. This may reduce the possibility that dust enters the system.
- After disconnecting the fitting, cover both sides with the cover cap, plug or tape, to prevent the dust, foreign matter and moisture from entering.
- Keep all the tools clean and dry, including the intake manifold gauge set and all replacement parts.
- Add polyether type (PAG) air conditioning lubricant with the clean and dry delivery device and container, to make sure that the air conditioning lubricant is not affected by moisture.
- When turning the air conditioning system on, make some preparations in advance to complete all the operations rapidly. Leave the time of the air conditioning system being on as short as possible.
- Drain and refill the air conditioning system that has been turned on.

All service parts have been dried and sealed at factory. These sealed parts should be opened only when they are to be connected. All parts must reach the room temperature before stripping. This prevents the moisture in the air from condensing on the parts and being brought to the system. Reseal all the parts as soon as possible.

Discharging, Adding, Draining and Filling Procedures for Air Conditioning System

Warning: *Avoid inhaling air conditioning refrigerant 134a(R-134a) and lubricant vapor or oil mist. Contact with them could hurt the eyes, nose and throat. Work should be performed in the area with good air ventilation. In order to remove R-134a from the air conditioning system, use the repair equipment certified by SAE J 2210 (R-134a recirculation equipment). If the system leaks accidentally, ventilation of the work area is necessary before proceeding. Other information about health and safety can be obtained from refrigerant and lubrication manufacturers.*

Filling station could complete the recovery, draining and refilling procedures for the air conditioning system with just one connection. Refrigerant is filtered during recovering and draining, to make sure that the clean and dry refrigerant is added to the air conditioning system.

- Adding R-12 to the system that has filled with R-134a is prohibited. Refrigerant and refrigerant oil in both systems are incompatible, so never mix them even in small amount. Mixing the remaining refrigerant may damage the device.
- Do not use adapters with different diameters. Using these adapters may cause contamination, resulting in system malfunction.

Recovery of Refrigerant

1. Connect the high pressure side hose with quick disconnect port to the high pressure side service joint of the vehicle air conditioning system.

Tip: *Only use refrigerant tank designed for the service station. Overcharging restraint mechanism of service station is customized for this kind of refrigerant tank. The refrigerant tank valve is also designed for the restraint system.*

2. Turn the interface valve on.
3. Connect the low pressure side hose with quick disconnect port to the low pressure side service joint of the vehicle air conditioning system.
4. Turn the interface valve on.

Warning: *If there is no refrigerant in the system, stop the recovery operation immediately, or air will be sucked into the tank.*

5. Check the gauges on high and low pressure sides on the control panel in the filling station, and, make sure there is pressure in the air conditioning system. If there is no pressure, there is recoverable refrigerant in the system.
6. Turn the valves on high and low pressure sides on.
7. Turn the gas valve and liquid valve on refrigerant tank

on.

8. Release the refrigerant oil from the oil separator.
9. Turn the drain valve off.
10. Connect the filling station to the appropriate power outlet socket.
11. Turn the main power switch on.

Caution: Reusing the used air conditioning lubricant is prohibited. Otherwise, the air conditioning system will be damaged.

Caution: The polyether lubricant in part of the air conditioning system could be recycled together with the refrigerant. The quantity of the recycled lubricant is variable. The filling station can separate the lubricant from the refrigerant to judge the quantity of the recycled lubricant.

Caution: The same quantity of lubricant must be added during refilling the system.

12. Start recovering. For the information about the filling station, refer to the manufacturer's instruction for use.
13. Wait for 5 minutes, and then check the pressure gauge on the low pressure side of the control panel. If vacuum can be maintained in the air conditioning system, the recovery is completed.

Warning: If control indicator displays that the tank is full and the filling station is off during recovering, fit an empty tank to store the refrigerant which will be needed in the post process. DO NOT use any other type of refrigerant tank.

14. If the pressure on the low pressure side increases from zero, there is some refrigerant in the system. Recover the remaining refrigerant. Repeat this procedure, until the vacuum can be maintained in the system for 2 minutes.

Draining

1. Check whether the hoses on the high and low pressure sides are connected to the air conditioning system. Turn the valves on the high and low pressure sides in the filling station control panel on.
2. Turn the gas valve and liquid valve on the refrigerant tank on.

Caution: The system must be evacuated before recharging the refrigerant.

3. Start the vacuum pump and begin to drain. During recirculation, non-concrete gas (mostly air) be drained from the tank automatically. Sound of pressure being released may be heard.
4. Check the system for leaks. For the information about the filling station, refer to the manufacturer's

instruction for use.

Filling and Supplement of Air Conditioning System Lubricant

At this time, supplementing the lubricant drained from the air conditioning system during recovery is necessary.

Important:

- Screw the bottle cap on at any time, to prevent moisture and contamination entering.
 - This operation requires air conditioning to be in vacuum. Never turn the lubricant filling valve on when the air conditioning system is under positive pressure. This may cause lubricant to return through the oil bottle ventage.
 - When filling or supplementing lubricant, it is prohibited that the oil level stays below the suction tube, or the air will enter the air conditioning system.
1. Use the bottled polyether lubricant with the scale that is specified for R-134a system.
 2. For the information about the filling station, refer to the manufacturer's instruction for use. Fill the system with correct amount of air conditioning lubricant.
 3. When the amount of the oil that is filled meets the required amount, turn the valve off.

Refill

Caution: The system must be evacuated before recharging the refrigerant.

1. Turn the low pressure side valve on the control panel off.
2. Turn the high pressure side valve on the control panel on.
3. For the information about the filling station, refer to the manufacturer's instruction for use.
4. Refill the air conditioner with the necessary amount of refrigerant, and make sure the unit of measurement is correct.
5. Start filling.

Refrigerant Filling Completes Successfully

1. Turn off the high pressure side valve on the filling station control panel. Both the valves should be off.
2. Start the vehicle and air conditioning system.
3. Keep the engine operating, until the readings on the high pressure gauge and low pressure gauge are stable.
4. Compare the readings with the system specifications.
5. Check the evaporator outlet temperature, make sure the operation of the air conditioning system corresponds with the system specifications.
6. Keep the air conditioner operating.
7. Turn off the interface valve on the high pressure side.

8. Disconnect the high pressure side hose from the vehicle.
9. Turn on the valves on high and low pressure sides. Refrigerant from both the hoses will be sucked by the system rapidly through the hose on low pressure side.
10. Turn off the interface valve on low pressure side.
11. Disconnect the low pressure side hose from the vehicle.

Refrigerant Filling Failed

Sometimes, the added refrigerant is not input to the air conditioning system completely. There are two reasons for this:

1. The refrigerant tank pressure in the filling station is almost the same with that in the air conditioning system.
 - Resulting in the low process of delivery.
 - For the information about the filling station, refer to the manufacturer's instruction for use.
2. Insufficient refrigerant in the refrigerant tank of the filling station for filling.
 - For this reason, it is necessary to recover some added refrigerant from the vehicle, and then drain the air conditioning system and refill again.
 - For the information about the filling station, refer to the manufacturer's instruction for use.

Compressor

Removal

1. Disconnect the battery earth lead.
2. Recover air conditioning refrigerant.

Recovery of Air Conditioning Refrigerant

3. Lift up and support the vehicle.
4. Remove the engine drive belt.

Accessory Belt Removal

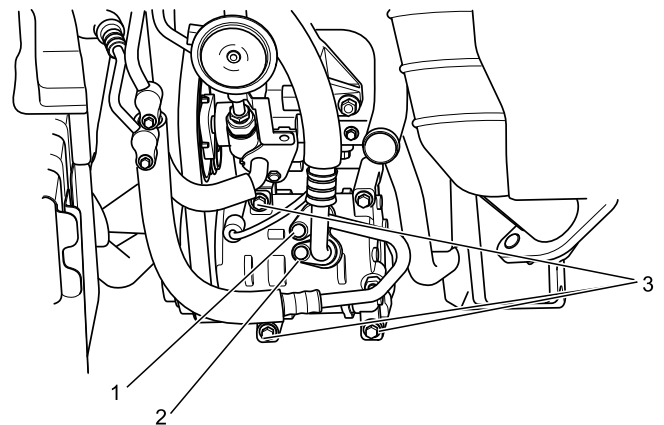
5. Disconnect the compressor clutch coil electrical connector.
6. Remove the compressor suction hose hold-down plate bolt (2).
7. Disconnect the compressor suction hose from the compressor.

Caution: Plug the disconnected unions to prevent contamination entering.

8. Remove and dispose of the O-ring seal.
9. Remove the compressor exhaust hose hold-down plate bolt (1).
10. Disconnect the compressor exhaust hose from the compressor.

Caution: Plug the disconnected unions to prevent contamination entering.

11. Remove and dispose of the O-ring seal.
12. Remove the compressor to engine set bolt (3).
13. Remove the compressor from the engine.



Refit

1. Fit the compressor to the engine.
2. Fit the compressor set bolt to the engine, and tighten the bolt to **19-25 Nm**.
3. Replace the O-ring seal with a new one, and then fit it to the compressor exhaust hose.
4. Fit the compressor exhaust hose to the compressor.
5. Fit the compressor exhaust hose hold-down plate bolt, and tighten it to **19-25 Nm**.

6. Replace the O-ring seal with a new one, and then fit it to the compressor suction hose.
7. Fit the compressor suction hose to the compressor.
8. Fit the compressor suction hose hold-down plate bolt, and tighten it to **19-25 Nm**.
9. Connect the compressor clutch coil electrical connector.
10. Fit the engine drive belt.

Accessory Tensioner Belt Refit

11. Lower the vehicle.
12. Refill with air conditioner refrigerant.

Refilling of Air Conditioner Refrigerant

13. Perform the leak test.
14. Connect the battery earth lead.

Compressor Suction Hose

Removal

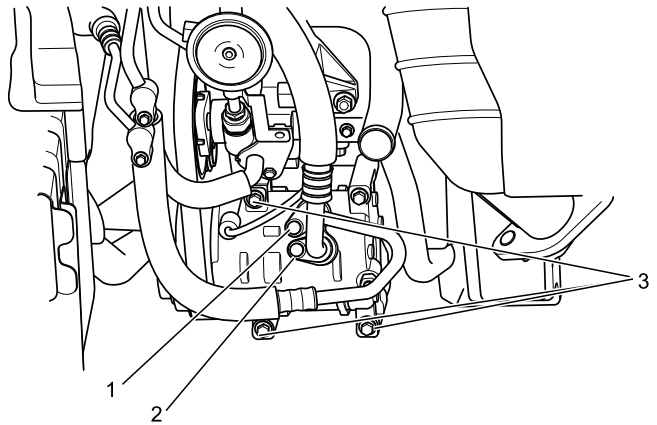
1. Recover air conditioning refrigerant.

Recovery of Air Conditioning Refrigerant

2. Remove the compressor suction hose to the compressor hold-down plate bolt (2).
3. Disconnect the compressor suction hose from the compressor.

Caution: *Plug the disconnected unions to prevent contamination entering.*

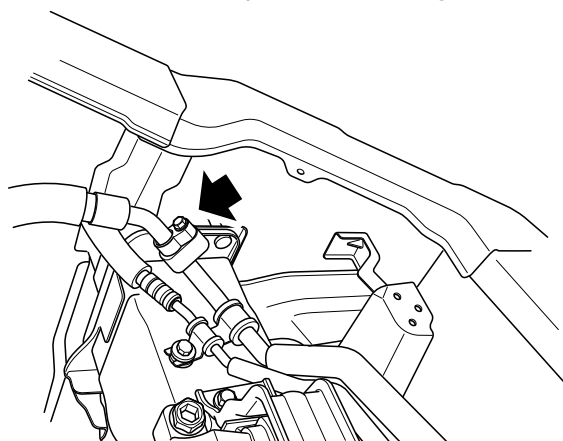
4. Remove and dispose of the O-ring seal.



5. Remove the compressor suction hose to the air conditioner EVP pipe assembly hold-down plate bolt.
6. Disconnect the compressor suction hose from the air conditioner EVP pipe assembly.

Caution: *Plug the disconnected unions to prevent contamination entering.*

7. Remove and dispose of the O-ring seal.



8. Remove the compressor suction hose from the vehicle.

Refit

1. Fit the compressor suction hose to the vehicle.
2. Replace the O-ring seal with a new one, and then fit it to the compressor suction hose.
3. Fit the compressor suction hose to the compressor.
4. Fit the suction hose to compressor hold-down plate

bolt, and tighten it to **19-25 Nm**.

5. Replace the O-ring seal with a new one, and then fit it to the compressor suction hose.
6. Fit the compressor suction hose to the air conditioner EVP pipe assembly.
7. Fit the suction hose to the air conditioner EVP pipe assembly hold-down plate bolt, and then tighten the bolt to **7-10 Nm**.
8. Refill with air conditioner refrigerant.

 **Refilling of Air Conditioner Refrigerant**

Compressor Exhaust Hose

Removal

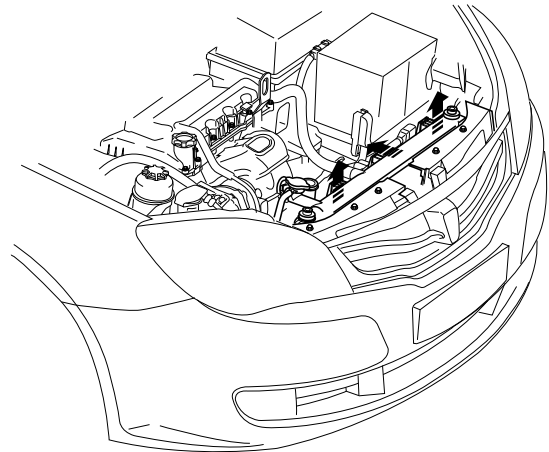
1. Recover air conditioning refrigerant.

 **Recovery of Air Conditioning Refrigerant**

2. Remove the radiator upper crossmember.

 **Radiator Upper Crossmember Removal**

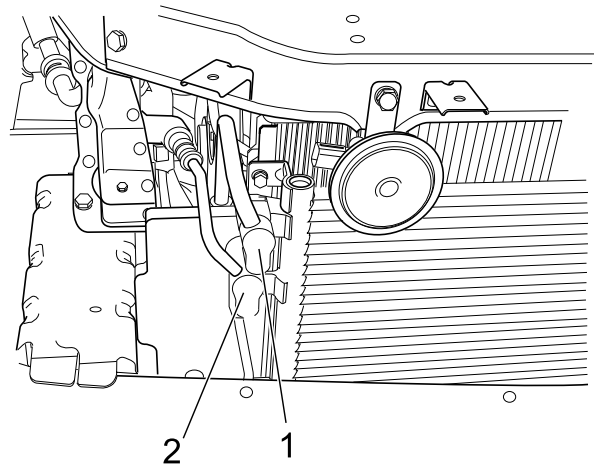
3. Lift the condenser up and move it toward the engine.



4. Remove the compressor exhaust hose to the condenser hold-down plate bolt (1).
5. Disconnect the compressor exhaust hose from the condenser.

Caution: Plug the disconnected unions to prevent contamination entering.

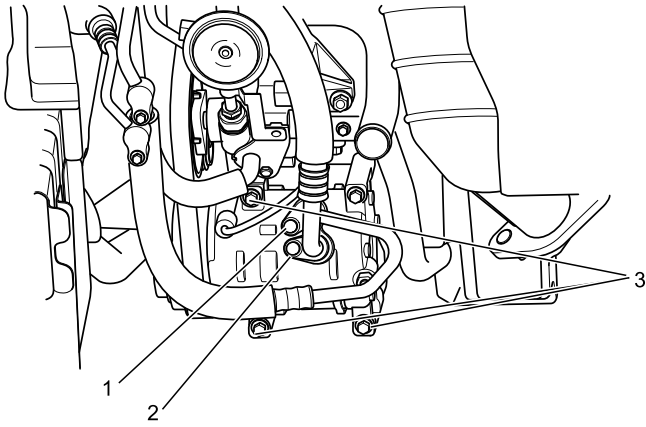
6. Remove and dispose of the O-ring seal.



7. Remove the compressor exhaust hose to the compressor hold-down plate bolt (2).
8. Disconnect the compressor exhaust hose from the compressor.

Caution: Plug the disconnected unions to prevent contamination entering.

9. Remove and dispose of the O-ring seal.



10. Remove the compressor exhaust hose from the vehicle.

Refit

1. Fit the compressor exhaust hose to the vehicle.
2. Replace the O-ring seal with a new one, and then fit it to the compressor exhaust hose.
3. Fit the compressor exhaust hose to the compressor.
4. Fit the exhaust hose to compressor hold-down plate bolt, and tighten it to **19-25 Nm**.
5. Replace the O-ring seal with a new one, and then fit it to the compressor exhaust hose.
6. Fit the compressor exhaust hose to the condenser.
7. Fit the exhaust hose to condenser hold-down plate bolt, and then tighten the bolt to **7-10 Nm**.
8. Fit the condenser to the radiator support.
9. Fit the radiator upper crossmember.

Radiator Upper Crossmember Refit

10. Refill with air conditioner refrigerant.

Refilling of Air Conditioner Refrigerant

Air Conditioner EVP Pipe Assembly

Removal

1. Recover air conditioning refrigerant.

Recovery of Air Conditioning Refrigerant

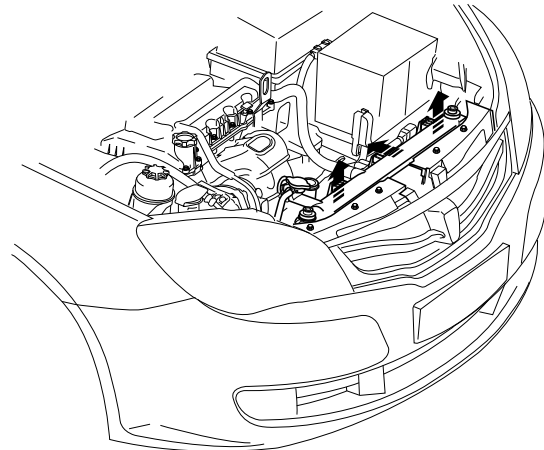
2. Remove the air conditioner pressure switch.

Air Conditioner Pressure Switch Removal

3. Remove the radiator upper crossmember.

Radiator Upper Crossmember Removal

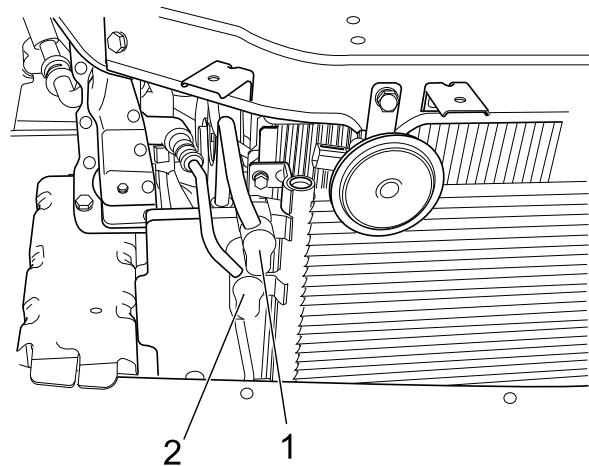
4. Lift the condenser up and move it toward the engine.



5. Remove the air conditioner EVP pipe assembly to condenser hold-down plate bolt (2).
6. Disconnect the air conditioner EVP pipe assembly from the condenser.

Caution: Plug the disconnected unions to prevent contamination entering.

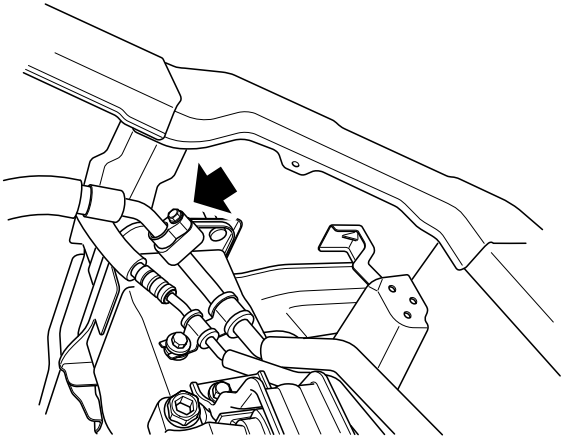
7. Remove and dispose of the O-ring seal.



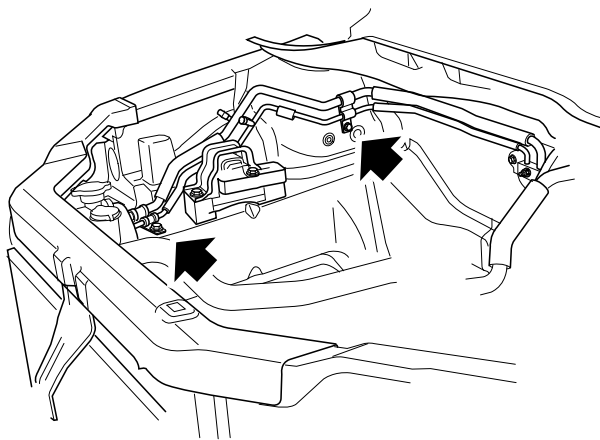
8. Remove the compressor suction hose to the air conditioner EVP pipe assembly hold-down plate bolt.
9. Disconnect the compressor suction hose from the air conditioner EVP pipe assembly.

Caution: Plug the disconnected unions to prevent contamination entering.

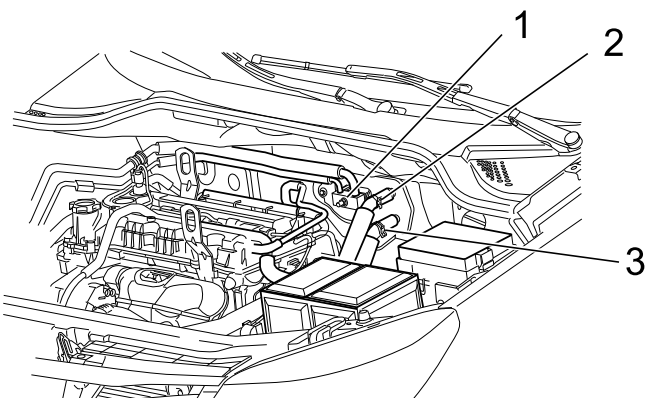
10. Remove and dispose of the O-ring seal.



11. Remove the air conditioner EVP pipe assembly mounting bracket tightening nut.



12. Remove the air conditioner EVP pipe assembly to the hot expansion valve hold-down plate nut (1).
13. Disconnect the air conditioner EVP pipe assembly from the hot expansion valve.
14. Remove and dispose of the O-ring seal.



15. Remove the air conditioner EVP pipe assembly from the vehicle.

Refit

1. Fit the air conditioner EVP pipe assembly to the vehicle.
2. Replace the O-ring seal with a new one, and then fit it to the air conditioner EVP pipe assembly.
3. Fit the air conditioner EVP pipe assembly to the hot expansion valve.

4. Fit the air conditioner EVP pipe assembly to the hot expansion valve hold-down plate nut, and then tighten the nut to **19-25 Nm**.
5. Fit the air conditioner EVP pipe assembly mounting bracket, and then fit the tightening nut and tighten it to **7-10 Nm**.
6. Replace the O-ring seal with a new one, and then fit it to the compressor suction hose.
7. Fit the compressor suction hose to the air conditioner EVP pipe assembly.
8. Fit the suction hose to the air conditioner EVP pipe assembly hold-down plate bolt, and then tighten the bolt to **7-10 Nm**.
9. Replace the O-ring seal with a new one, and then fit it to the air conditioner EVP pipe assembly.
10. Fit the air conditioner EVP pipe assembly to the condenser.
11. Fit the air conditioner EVP pipe assembly to condenser hold-down plate bolt, and then tighten the bolt to **7-10 Nm**.
12. Fit the condenser to the radiator support.
13. Fit the radiator upper crossmember.

 **Radiator Upper Crossmember Refit**

14. Fit the air conditioner pressure switch.

 **Air Conditioner Pressure Switch Refit**

15. Refill with air conditioner refrigerant.

 **Refilling of Air Conditioner Refrigerant**

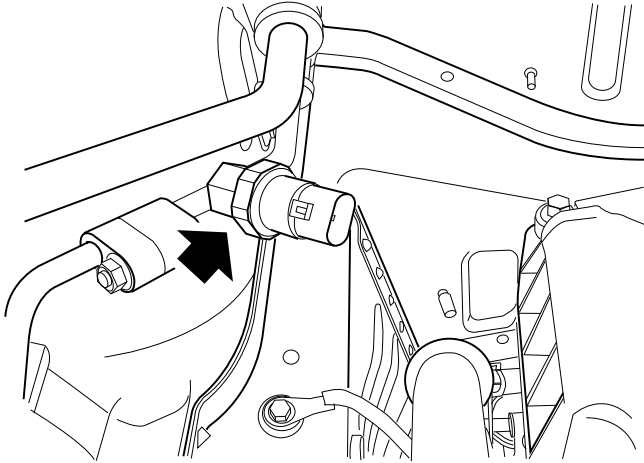
Pressure Switch

Removal

1. Recover air conditioning refrigerant.

 **Recovery of Air Conditioning Refrigerant**

2. Remove the air conditioner pressure switch.
3. Dispose of the O-ring seal.



Refit

1. Replace the O-ring seal with a new one, and then fit it to the air conditioner pressure switch.
2. Fit the air conditioner pressure switch to the air conditioning tube and tighten it.
3. Refill with air conditioner refrigerant.

 **Refilling of Air Conditioner Refrigerant**

Condenser

Removal

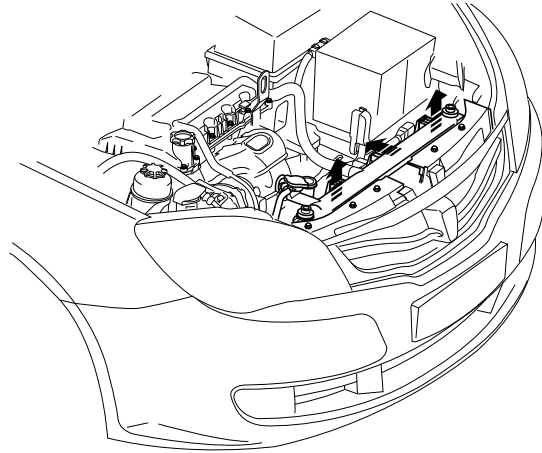
1. Recover air conditioning refrigerant.

 **Recovery of Air Conditioning Refrigerant**

2. Remove the cooling fan.
3. Remove the radiator upper crossmember.

 **Radiator Upper Crossmember Removal**

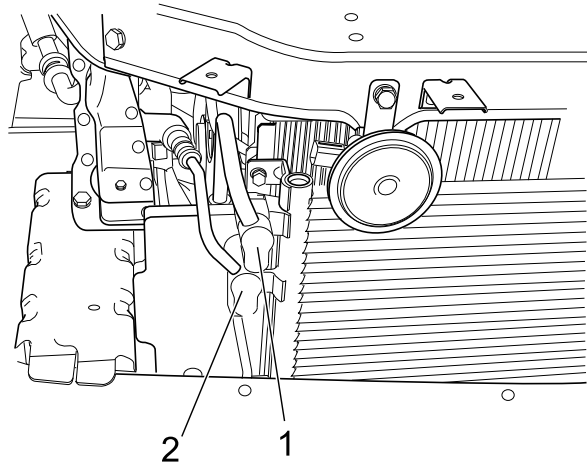
4. Lift the condenser up and move it toward the engine.



5. Remove the air conditioner EVP pipe assembly to condenser hold-down plate bolt (2).
6. Disconnect the air conditioner EVP pipe assembly from the condenser.

Caution: Plug the disconnected unions to prevent contamination entering.

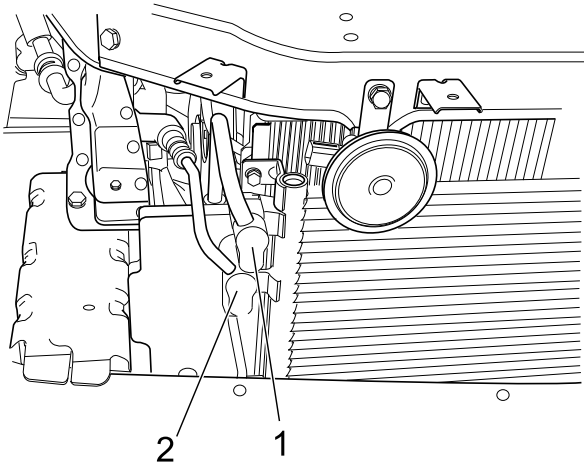
7. Remove and dispose of the O-ring seal.



8. Remove the compressor exhaust hose to the condenser hold-down plate bolt (1).
9. Disconnect the compressor exhaust hose from the condenser.

Caution: Plug the disconnected unions to prevent contamination entering.

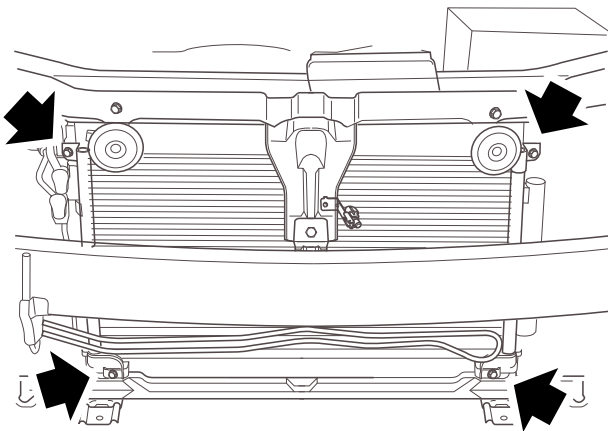
10. Remove and dispose of the O-ring seal.



12. Refill with air conditioner refrigerant.

Refilling of Air Conditioner Refrigerant

11. Remove the condenser to radiator tightening bolt.



12. Remove the condenser from the vehicle.

Refit

1. Fit the condenser to the vehicle.
2. Fit the condenser to radiator tightening bolt, and tighten it to **5.5-7.5 Nm**.
3. Replace the O-ring seal with a new one, and then fit it to the compressor exhaust hose.
4. Fit the compressor exhaust hose to the condenser.
5. Fit the exhaust hose to condenser hold-down plate bolt, and then tighten the bolt to **7-10 Nm**.
6. Replace the O-ring seal with a new one, and then fit it to the air conditioner EVP pipe assembly.
7. Fit the air conditioner EVP pipe assembly to the condenser.
8. Fit the air conditioner EVP pipe assembly to condenser hold-down plate bolt, and then tighten the bolt to **7-10 Nm**.
9. Fit the condenser to the radiator support.
10. Fit the radiator upper crossmember.

Radiator Upper Crossmember Refit

11. Fit the cooling fan

Cooling Fan Refit

HVAC Module Assembly

Removal

1. Disconnect the battery earth lead.
2. Recover air conditioning refrigerant.

Recovery of Air Conditioning Refrigerant

3. Drain the coolant.

Draining of Coolant

4. Remove the upper instrument panel assembly.

Upper Instrument Panel Assembly Removal

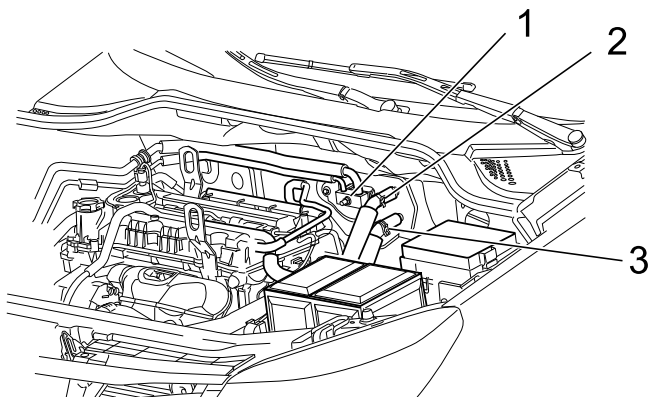
5. Remove the lower instrument panel assembly.

Lower Instrument Panel Assembly Removal

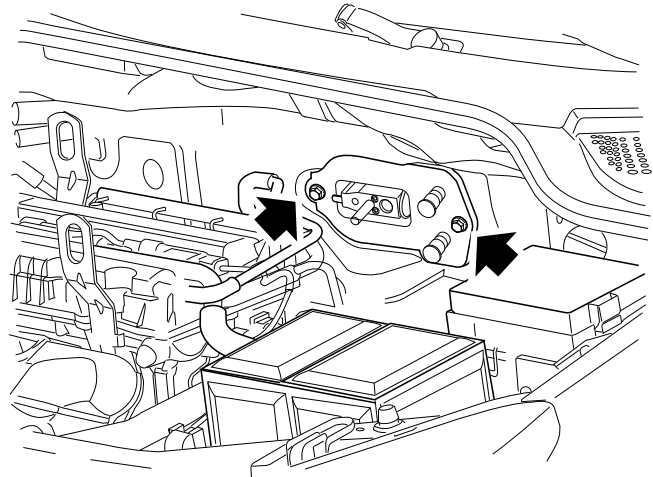
6. Disconnect the HVAC module wire harness and instrument panel wire electrical connectors.
7. Loosen the clamp of the heater end on the heater water pipe inlet, and disconnect the heater water pipe inlet from the heater (2).
8. Loosen the clamp of the heater end on the heater water pipe outlet, and disconnect the heater water pipe outlet from the heater (3).
9. Remove the air conditioner EVP pipe assembly to the hot expansion valve hold-down plate nut (1).
10. Disconnect the air conditioner EVP pipe assembly from the hot expansion valve.

Caution: Plug the disconnected unions to prevent contamination entering.

11. Remove and dispose of the O-ring seal.



12. Ask your assistant to support the HVAC module assembly in cabin, then remove the HVAC module assembly mounting bolt.



13. Remove the HVAC module assembly from the vehicle.

Refit

1. Fit the HVAC module assembly to the vehicle.
2. Ask your assistant to support the HVAC module assembly in cabin, then fit the HVAC module assembly mounting bolt and tighten it to **3-4 Nm**.
3. Replace the O-ring seal with a new one, and then fit it to the air conditioner EVP pipe assembly.
4. Fit the air conditioner EVP pipe assembly to the hot expansion valve.
5. Fit the air conditioner EVP pipe assembly to the hot expansion valve hold-down plate nut, and then tighten the nut to **19-25 Nm**.
6. Fit the heater outlet water pipe to the heater, and hold it with the clamp.
7. Fit the heater inlet water pipe to the heater, and hold it with the clamp.
8. Connect the HVAC module wire harness and instrument panel wire electrical connectors.
9. Fit the lower instrument panel assembly.

Lower Instrument Panel Assembly Refit

10. Fit the upper instrument panel assembly.

Upper Instrument Panel Assembly Refit

11. Refill with coolant.

Filling of Coolant

12. Refill with air conditioner refrigerant.

Refilling of Air Conditioner Refrigerant

13. Connect the battery earth lead.

Evaporator Core

Removal

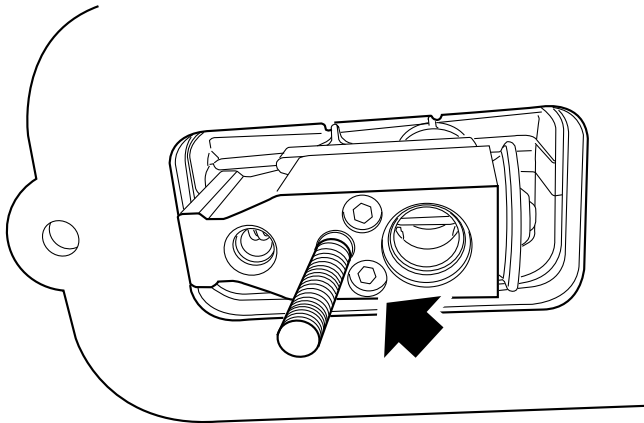
1. Remove the HVAC module assembly.

HVAC Module Assembly Removal

2. Remove the hot expansion valve to evaporator core tightening bolt.
3. Remove the hot expansion valve from the evaporator core.

Caution: Plug the disconnected unions to prevent contamination entering.

4. Dispose of the O-ring seal.



5. Remove the evaporator core case set screw.
6. Remove the evaporator core from the HVAC module assembly.
7. Remove the evaporator core temperature sensor from the evaporator core (only for the automatic air conditioner).

Refit

1. Fit the evaporator core temperature sensor to the evaporator core. (only for the automatic air conditioner).
2. Fit the evaporator core to the HVAC module assembly.
3. Fit the evaporator core case set screw and tighten it.
4. Replace the O-ring seal with a new one, and then fit it to the evaporator core pipe.
5. Fit the hot expansion valve to the evaporator core.
6. Fit the hot expansion valve to evaporator core tightening bolt, and tighten it to **4-6 Nm**.
7. Fit the HVAC module assembly.

HVAC Module Assembly Refit

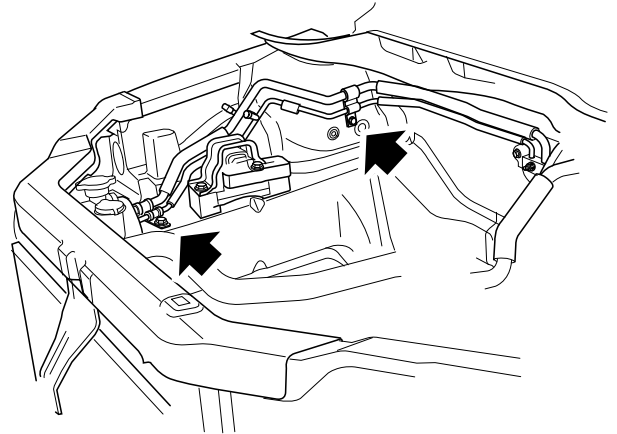
Expansion Valve

Removal

1. Recover air conditioning refrigerant.

Recovery of Air Conditioning Refrigerant

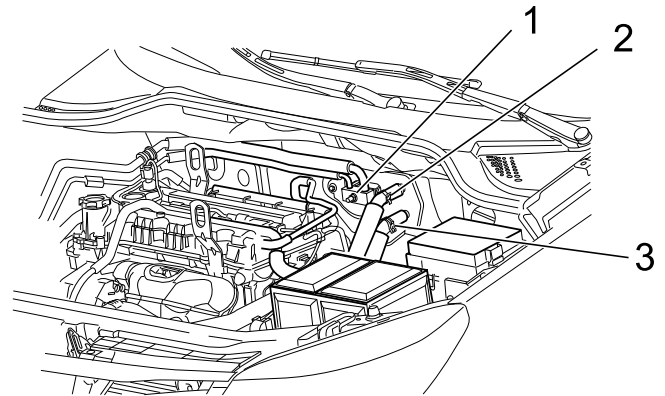
2. Remove the air conditioner EVP pipe assembly mounting bracket tightening nut.



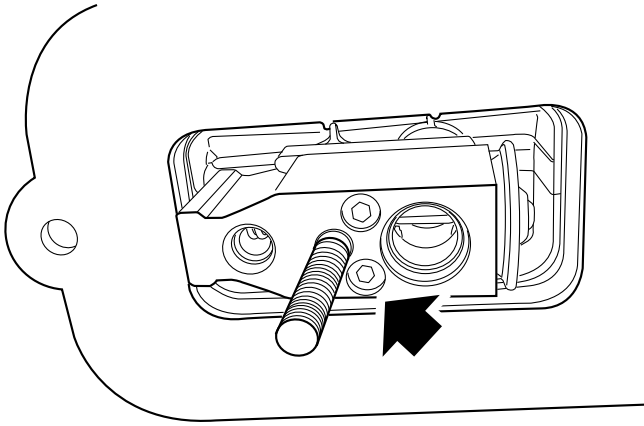
3. Remove the air conditioner EVP pipe assembly to the hot expansion valve hold-down plate nut (1).
4. Disconnect the air conditioner EVP pipe assembly from the hot expansion valve.

Caution: Plug the disconnected unions to prevent contamination entering.

5. Remove and dispose of the O-ring seal.



6. Remove the hot expansion valve to evaporator core tightening bolt.
7. Remove the hot expansion valve from the evaporator core.
8. Dispose of the O-ring seal.



Refit

1. Replace the O-ring seal with a new one, and then fit it to the evaporator core pipe.
2. Fit the hot expansion valve to the evaporator core.
3. Fit the hot expansion valve to evaporator core tightening bolt, and tighten it to **4-6 Nm**.
4. Replace the O-ring seal with a new one, and then fit it to the air conditioner EVP pipe assembly.
5. Fit the air conditioner EVP pipe assembly to the hot expansion valve.
6. Fit the air conditioner EVP pipe assembly to the hot expansion valve hold-down plate nut, and then tighten the nut to **19-25 Nm**.
7. Fit the air conditioner EVP pipe assembly mounting bracket, and then fit the tightening nut and tighten it to **7-10 Nm**.
8. Refill with air conditioner refrigerant.

Refilling of Air Conditioner Refrigerant

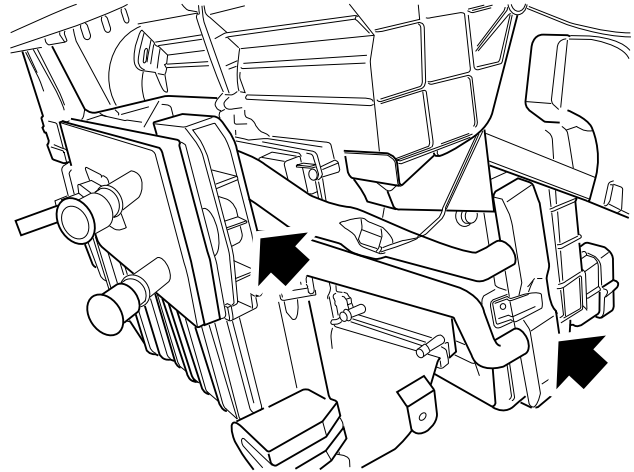
Heater Core

Removal

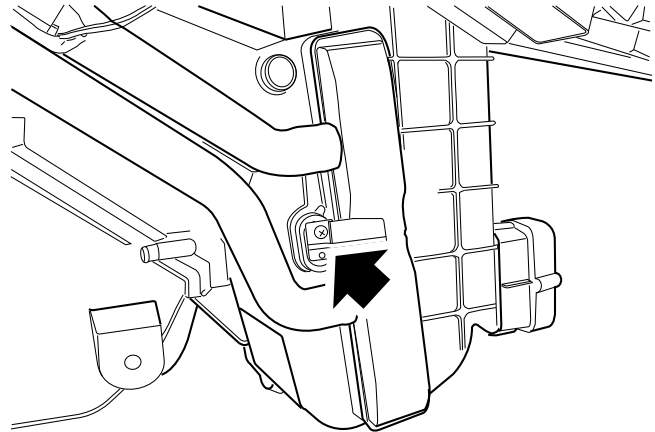
1. Remove the HVAC module assembly.

HVAC Module Assembly Removal

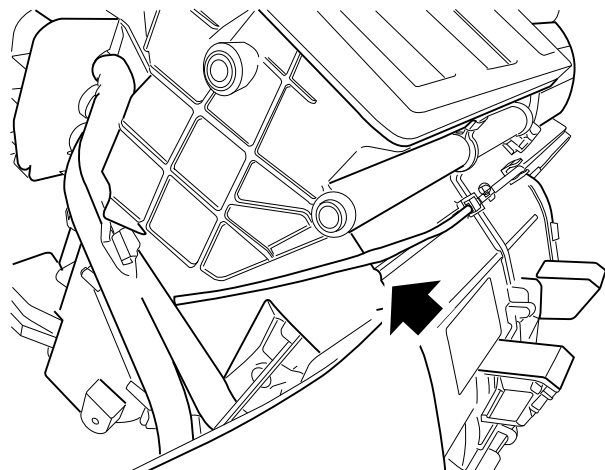
2. Remove the HVAC module assembly mounting grommet.
3. Remove the heater core inlet and outlet pipe hold-down plate tightening screw.
4. Remove the heater core inlet and outlet pipe hold-down plate.



5. Remove the heater core baffle tightening screw.
6. Remove the heater core baffle.



7. Remove the heater core temperature sensor.



8. Pull the heater core out from the HVAC module assembly.

Refit

1. Fit the heater core into the HVAC module assembly.
2. Fit the heater core temperature sensor.
3. Fit the heater core temperature sensor.
4. Fit and tighten the heater core baffle tightening screw.
5. Fit the heater core inlet and outlet pipe hold-down plate.
6. Fit the heater core inlet and outlet pipe hold-down plate tightening screw, and tighten it.
7. Fit the HVAC module assembly mounting grommet.
8. Fit the HVAC module assembly.

 **HVAC Module Assembly Refit**

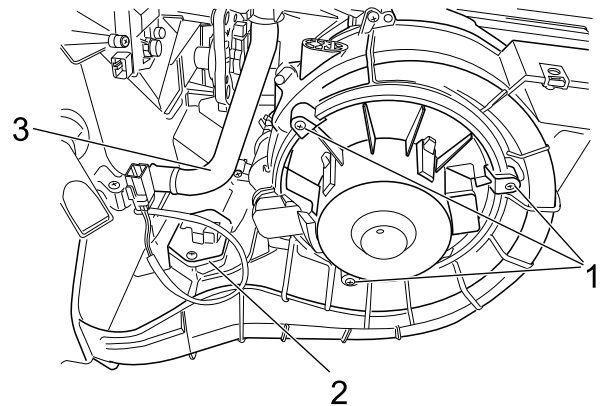
Blower Motor Assembly

Removal

1. Disconnect the battery earth lead.
2. Remove the glove box.

 **Glove Box Removal**

3. Disconnect the blower motor assembly electrical connector.
4. Remove the blower motor assembly set screws (I).



5. Remove the blower motor assembly.

Refit

1. Fit the blower motor assembly to the blower casing.
2. Fit the blower motor assembly set screws and tighten them.
3. Connect the blower motor assembly electrical connector.
4. Fit the glove box.

 **Glove Box Refit**

5. Connect the battery earth lead.

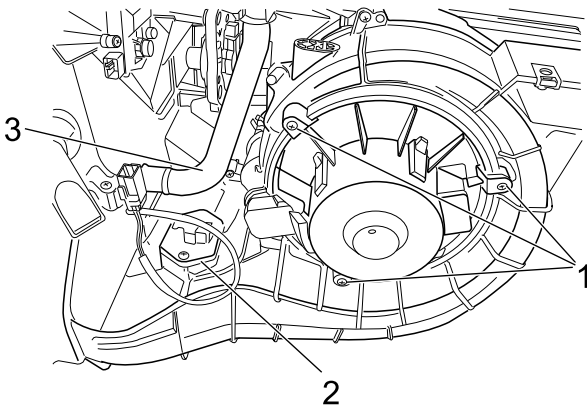
Blower Governor Resistor

Removal

1. Disconnect the battery earth lead.
2. Remove the glove box.

Glove Box Removal

3. Pull out the glove box vent tube (3).
4. Disconnect the blower governor resistor electrical connector.
5. Remove the blower governor resistor set screws.



6. Remove the blower governor resistor (2).

Refit

1. Fit the blower governor resistor to the blower casing.
2. Fit the blower governor resistor set screws and tighten them.
3. Connect the blower governor resistor electrical connector.
4. Fit the glove box vent tube.
5. Fit the glove box.

Glove Box Refit

6. Connect the battery earth lead.

HVAC Module Wire Harness Assembly

Removal

1. Disconnect the battery earth lead.
2. Remove the entertainment system.

Entertainment System Removal

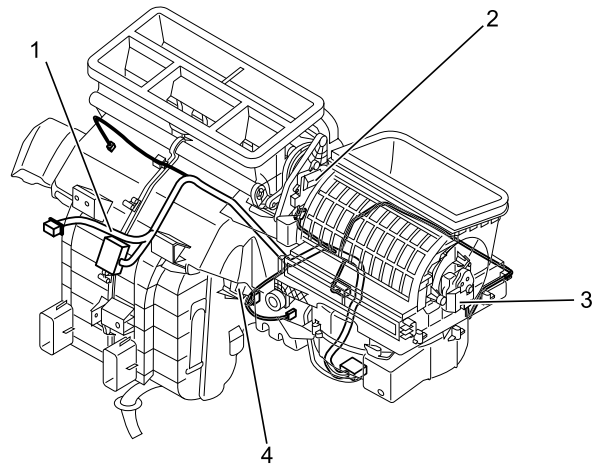
3. Remove the air conditioner control module.

Air Conditioner Control Module Removal

4. Remove the upper instrument panel assembly.

Upper Instrument Panel Assembly Removal

5. Disconnect all the electrical connectors on the HVAC module wire harness assembly (1).



6. Remove the HVAC module wire harness assembly from the vehicle.

Refit

1. Fit the HVAC module wire harness to the vehicle.
2. Connect all the electrical connectors on the HVAC module wire harness assembly.
3. Fit the upper instrument panel assembly.

Upper Instrument Panel Assembly Refit

4. Connect the battery earth lead.

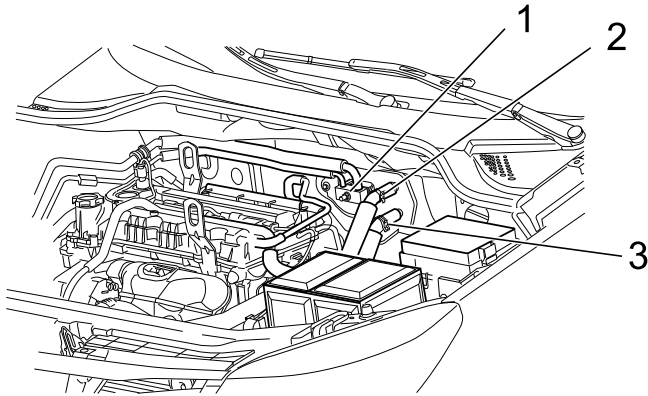
Heater Water Pipe Inlet

Removal

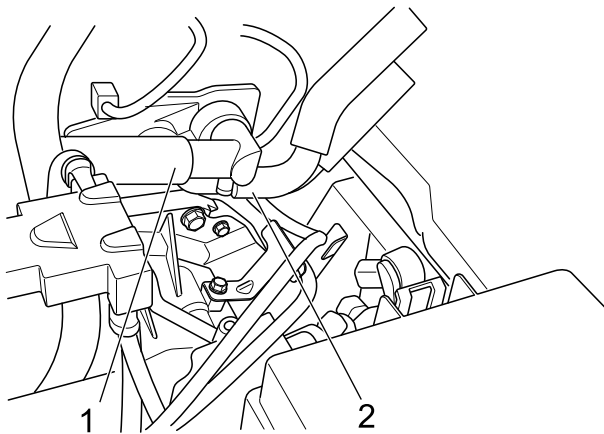
1. Drain the coolant.

 **Draining of Coolant**

2. Loosen the clamp of the heater end on heater water pipe inlet, and disconnect the heater water pipe inlet from the heater (2).



3. Loosen the clamp of the engine end on the heater water pipe inlet, and disconnect the heater water pipe inlet from the engine (2).



4. Remove the heater water pipe inlet from the vehicle.

Refit

1. Fit the heater inlet water pipe to the vehicle.
2. Fit the heater inlet water pipe to the engine, and hold it with the clamp.
3. Fit the heater inlet water pipe to the heater, and hold it with the clamp.
4. Refill with coolant.

 **Filling of Coolant**

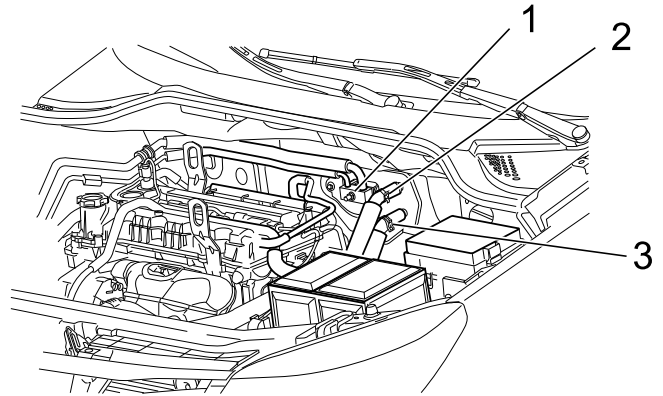
Heater Water Pipe Outlet

Removal

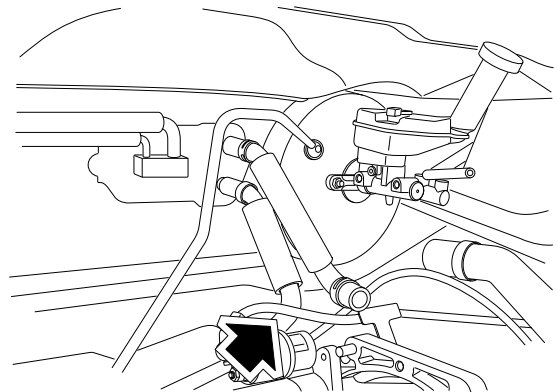
1. Drain the coolant.

 **Draining of Coolant**

2. Loosen the clamp of the heater end on the heater water pipe outlet, and disconnect the heater water pipe outlet from the heater (3).



3. Loosen the clamp of engine end on the heater water pipe outlet, and disconnect the heater water pipe outlet from the engine.



4. Remove the heater water pipe outlet from the vehicle.

Refit

1. Fit the heater outlet water pipe to the vehicle.
2. Fit the heater outlet water pipe to the engine, and hold it with the clamp.
3. Fit the heater outlet water pipe to the heater, and hold it with the clamp.
4. Refill with coolant.

 **Filling of Coolant**

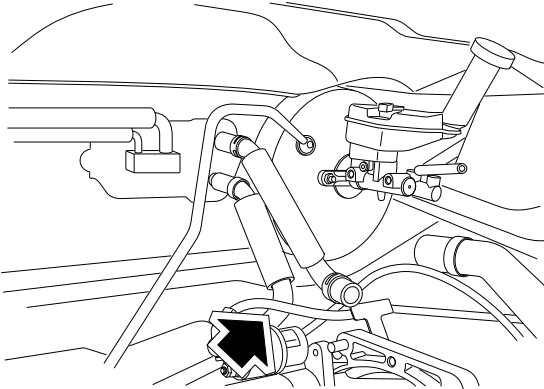
Oil Cooler Hose

Removal

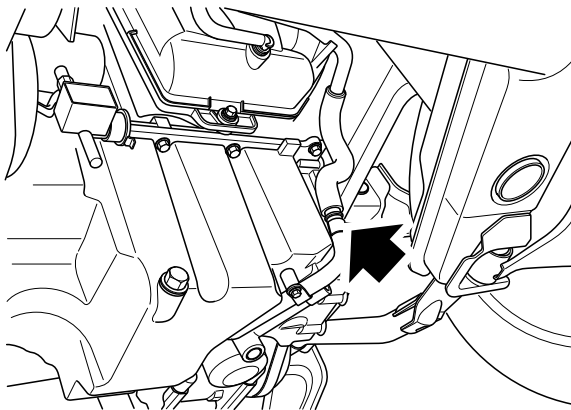
1. Drain the coolant.

 **Draining of Coolant**

2. Loosen the clamp on connection ends of the oil cooler hose and heater outlet hose, and disconnect the oil cooler hose from the heater outlet hose.



3. Lift up and support the vehicle.
4. Loosen the clamp on connection ends of the oil cooler hose and oil cooler, and disconnect the oil cooler hose from the oil cooler.



5. Remove the oil cooler hose from the vehicle.

Refit

1. Fit the oil cooler hose to the vehicle.
2. Fit the oil cooler hose to the oil cooler and hold it with the clamp.
3. Lower the vehicle.
4. Fit the oil cooler hose to the heater outlet hose connection ends, and hold them with the clamp.
5. Refill with coolant.

 **Filling of Coolant**

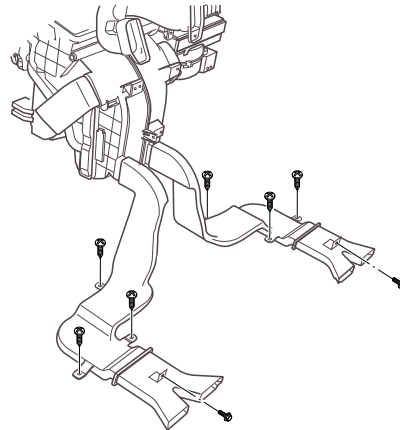
Floor Duct LH

Removal

1. Remove the driver side seat.

 **Front Seat Removal**

2. Lift the driver side floor.
3. Remove the floor duct LH set screw.
4. Remove the floor duct LH.



Refit

1. Fit the floor duct LH to the vehicle.
2. Fit the floor duct LH set screw, and tighten it to **4-6 Nm**.
3. Place the driver side floor again.
4. Fit the driver side seat.

 **Front Seat Refit**

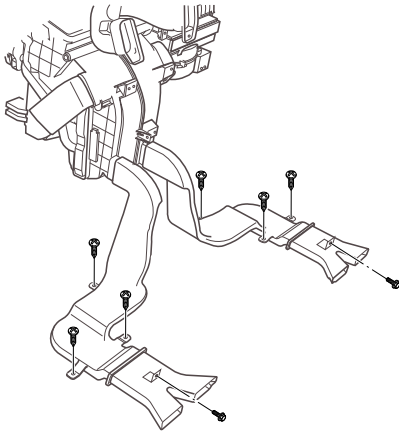
Floor Duct RH

Removal

1. Remove the passenger side seat.


 **Front Seat Removal**

2. Lift the passenger side floor.
3. Remove the floor duct RH set screw.
4. Remove the floor duct RH.



Refit

1. Fit the floor duct RH to the vehicle.
2. Fit the floor duct RH set screw, and tighten it to **4-6 Nm**.
3. Place up the passenger side floor again.
4. Fit the passenger side seat.

 **Front Seat Refit**

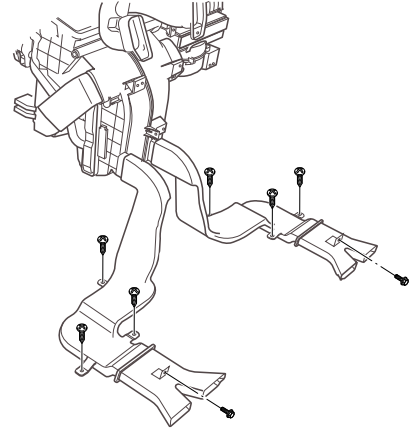
Floor Outlet LH

Removal

1. Remove the driver side seat.

 **Front Seat Removal**

2. Remove the floor outlet LH set screw.
3. Remove the floor outlet LH.



Refit

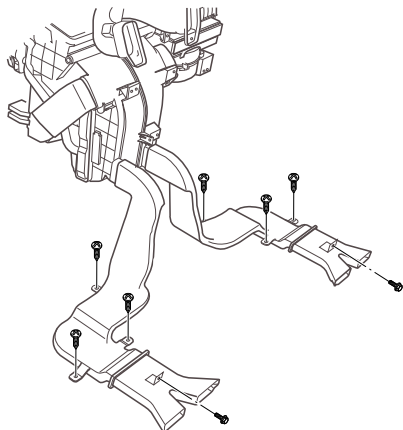
1. Fit the floor outlet LH to the vehicle.
2. Fit the floor outlet LH set screw, and tighten it to **4-6 Nm**.
3. Fit the driver side seat.

 **Front Seat Refit**

Floor Outlet RH

Removal

1. Remove the passenger side seat.
2. Remove the floor outlet RH set screw.
3. Remove the floor outlet RH.



Refit

1. Fit the floor outlet RH to the vehicle.
2. Fit the floor outlet RH set screw, and tighten it to **4-6 Nm**.
3. Fit the passenger side seat.

Front Seat Refit

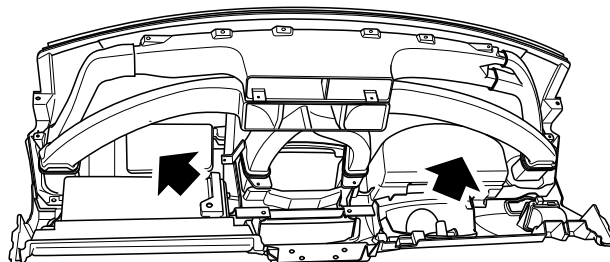
Instrument Panel Duct LH

Removal

1. Remove the instrument panel assembly.

Instrument Panel Assembly Removal

2. Remove the instrument panel duct LH set screw.
3. Remove the instrument panel duct LH.



Refit

1. Fit the instrument panel duct LH.
2. Fit the instrument panel duct LH set screw, and tighten it to **4-6 Nm**.
3. Fit the instrument panel assembly.

Instrument Panel Assembly Refit

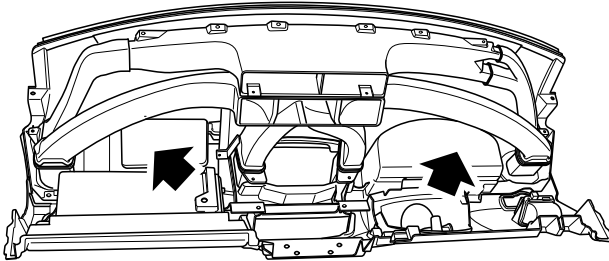
Instrument Panel Duct RH

Removal

1. Remove the instrument panel assembly.

 **Instrument Panel Assembly Removal**

2. Remove the instrument panel duct RH set screw.
3. Remove the instrument panel duct RH.



Refit

1. Fit the instrument panel duct RH.
2. Fit the instrument panel duct RH set screw, and tighten it to **4-6 Nm**
3. Fit the instrument panel assembly.

 **Instrument Panel Assembly Refit**

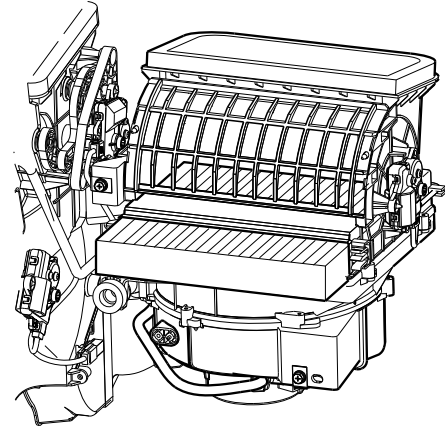
Passenger Compartment Air Cleaner

Removal

1. Remove the glove box assembly.

 **Glove Box Assembly Removal**

2. Remove the passenger compartment air cleaner cap.
3. Remove the passenger compartment air cleaner.



Refit

1. Fit the passenger compartment air cleaner.

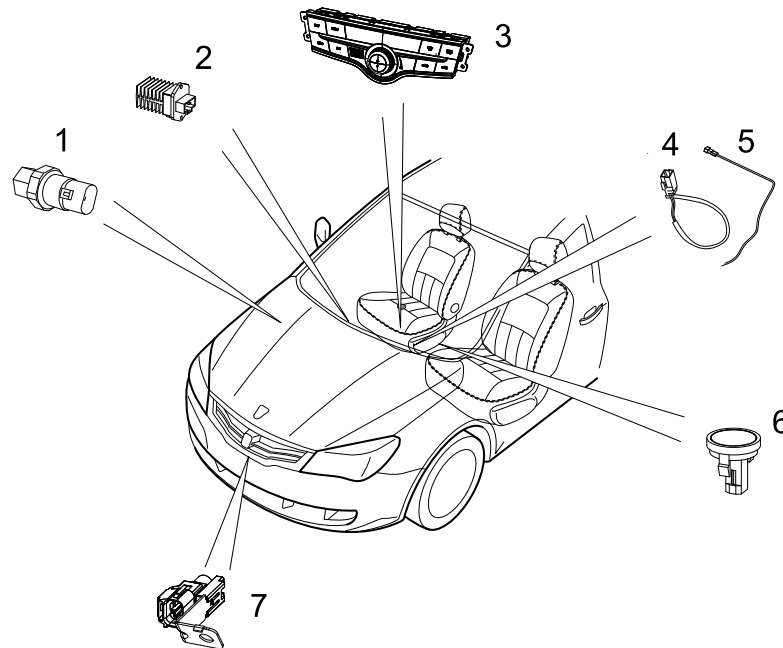
Caution: When fitting the air conditioning filter, make the upper pull side of the filter element face the operator and the arrow on the side of the filter element should face downward when fitting.

2. Fit the passenger compartment air cleaner cap.
3. Fit the glove box assembly.

 **Glove Box Assembly Refit**

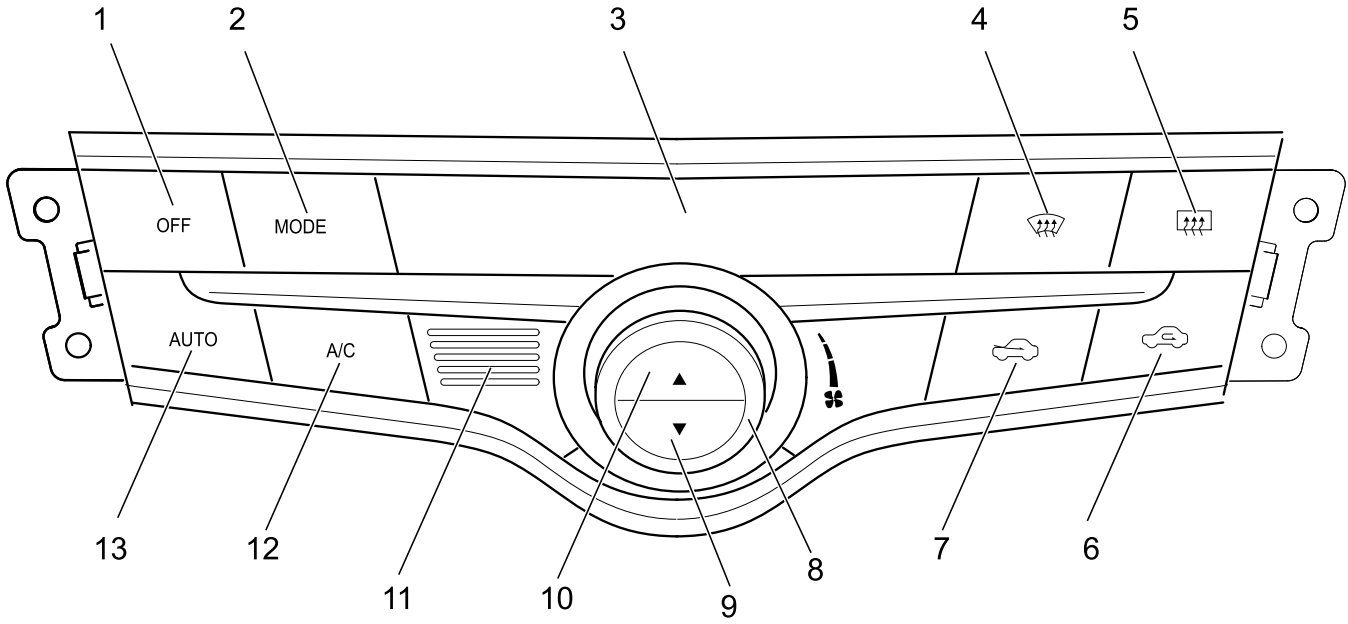
HVAC-ATC**Specifications****Torque**

| Description | Value |
|---|----------|
| Screw - Air Conditioner Controller Assembly Refit | 2.5-3 Nm |
| Screw - Temperature Damper Actuator Refit | 1-2 Nm |
| Screw - Mode Damper Actuator Refit | 1-2 Nm |
| Screw - Inner/Outer Recirculation Damper Actuator Refit | 1-2 Nm |
| Screw - Ambient Temperature Sensor Refit | 5-7 Nm |

Description and Operation**System Component Layout****Air Conditioner Control System Component Layout - Automatic Air Conditioner (ATC)**

- | | |
|--|---|
| 1. Air Conditioning Pressure Switch | 5. Heater Core Coolant Temperature Sensor |
| 2. Power Tube | 6. Solar Sensor |
| 3. Automatic Air Conditioner Controller Assembly (Integrated Room Temperature Sensor) | 7. Ambient Temperature Sensor |
| 4. Evaporator Temperature Sensor | |

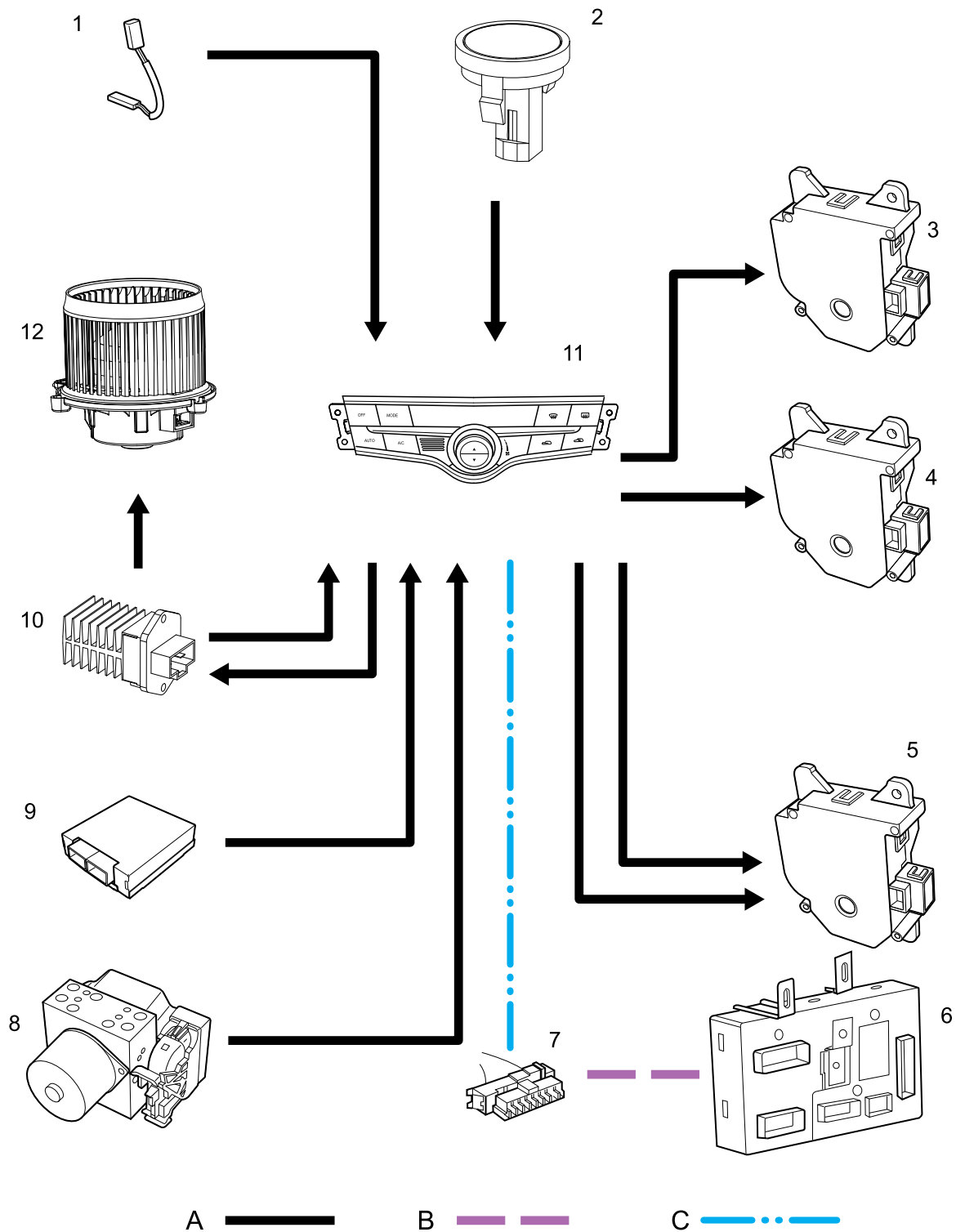
Control Panel - Automatic Air Conditioner (ATC)



- 1. Close (OFF) Switch
- 2. Mode Select Button
- 3. LCD Display
- 4. Defrost Mode Switch
- 5. Heated Rear Windshield (HRW) Switch
- 6. Inner Circulation Switch
- 7. Outer Circulation Switch
- 8. Blower Air Speed Control Knob
- 9. Temperature Decrease Button
- 10. Temperature Increase Button
- 11. Room Temperature Sensor
- 12. A/C Switch
- 13. Automatic Mode (AUTO) Switch

System Control Diagram

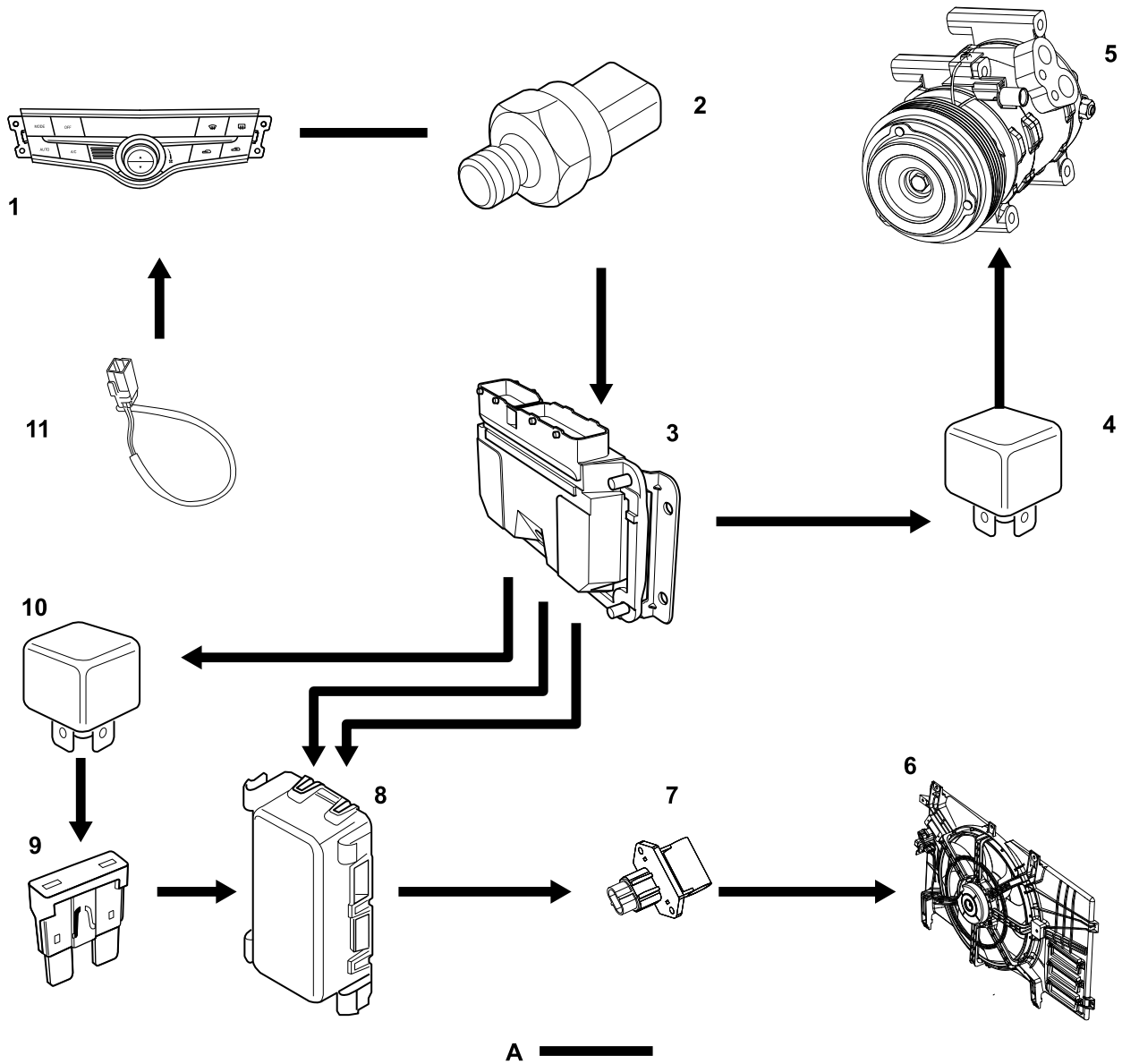
Air Conditioner Control Diagram - Automatic Air Conditioner (ATC)



A = Hard Wire; B = CAN Bus Line; C = K Wire

1. Heater Core Coolant Temperature Sensor
2. Solar Sensor
3. Mode Damper Servomotor
4. Mix Damper Servomotor
5. Fresh/Circulation Air Damper Servomotor
6. Body Control Module (**BCM**)
7. Diagnostic Socket
8. **ABS** Module
9. TCU Module
10. Blower Control Module
11. **ATC** Controller Assembly
12. Blower

Compressor and Cooling Fan Control Diagram – Automatic Air Conditioner (ATC)



A = Hard Wire;

- 1. **ATC** Controller Assembly
- 2. Air Conditioning Pressure Switch
- 3. **ECM**
- 4. A/C Compressor Relay
- 5. A/C Compressor
- 6. Cooling Fan
- 7. Cooling Fan Low Speed Resistor
- 8. Cooling Fan Relay Unit
- 9. Cooling Fan Relay Unit Fuse
- 10. Main Relay
- 11. Evaporator Temperature Sensor

Description

General Description

Automatic air conditioning system monitors the room temperature, outside temperature and adjusts the air outlet temperature, blower speed and air distribution automatically. Automatic mode provides the optimum system control mode and does not need manual interference. Manual mode allows to ignore the automatic operation of individual function, to adapt to personal preference.

Control System - Automatic Air Conditioning System (ATC)

Temperature/mode damper in HVAC module assembly is controlled by control system automatically, to control the air temperature and air distribution in the vehicle. Control system outputs **PWM** signal to blower control module to control the blower, and then the outlet volume. At the same time, it also outputs signals to **BCM**, to control the rear windshield heater. **ATC** Control system consists of the following:

- **ATCECU** (Integrated Room Temperature Sensor)
- Air Conditioning Pressure Switch
- Evaporator Temperature Sensor
- Solar Sensor
- Heater Core Coolant Temperature Sensor
- Blower Governor Module
- Ambient Temperature Sensor
- Damper Actuator
- Blower

ATC ECU

ATCECU is fitted in the centre of instrument panel under the radio. Integrated control panel on **ATCECU** contains a control input switch and a liquid crystal display **LCD** that provides system state information.

The output signals from sensor, control panel switch and **BCM**, **TCU**, **ABS** modules are processed by **ATC ECU**, and then **ATCECU** outputs appropriate control signal.

ATCECU is connected with **BCM** to control the rear windshield heater; **ATCECU** communicates with **ECM** via hard wire to control the compressor clutch; **ATCECU** receives the evaporator temperature directly to determine if the compressor clutch should be disengaged or engaged, avoid frosting on the evaporator surface and receive the ambient temperature information from the ambient temperature sensor on the front bumper.

Control Panel - Automatic Air Conditioner (ATC)

Automatic Operation Button -AUTO Button

- The system will enter full-automatic operation state and display **AUTO** symbol on the screen when pressing the automatic operation button. It will be considered as invalid command when pressing the button in automatic operation state.
- In this state, the operations of compressor, blower, circulation damper, temperature damper and mode damper will be adjusted by controller automatically.
- If any button except automatic operation button, temperature adjusting button, **HRW** button and **OFF** button is pressed, the system performs the command of the button, and cancels the **AUTO** symbol simultaneously. Other functions belonging to the automatic mode originally are continuously controlled by system automatically.
- When the air conditioning system is **OFF**, press the **AUTO**, the system turns on and enters **AUTO** state.
- When in automatic operation state, the state of other functions are displayed on **LCD** except the mode state.

Temperature Adjusting Button - Temperature Increase Button, Temperature Decrease Button

- The temperature can be set on the display ranges from 16°C to 28°C, and increases or decreases by 0.5°C every time the adjusting button is pressed. The initial temperature is 25°C.
- The room temperature will increase or decrease by 0.5°C every time the temperature adjusting button is pressed; The controller will receive continuous commands and update the setting value every 0.3 seconds, if press and hold **UP** and **DOWN** keys (for 1 second).
- When the temperature is 16°C and receives a command of temperature decreasing, the system enters the maximum cooling state, and the original screen set temperature displays "Lo" (**AUTO** and temperature unit symbol are not displayed).
- The following may be output forcibly when in maximum cooling state:
 1. Temperature damper to full cool position.
 2. Mode damper switches to **FACE** position only in automatic mode, and does not change in manual mode.
 3. Circulation damper, blower air volume becomes the maximum volume.
- When in maximum cooling operation state, exit the state when receiving the command of temperature increasing, and the set temperature of the screen returns to 16°C. **ATCECU** exits the **LO** mode when restarting,

and returns to 16°C to ensure the comfortable of the automatic air conditioner.

- When the temperature is 28°C and receives a command of temperature increasing, the system enters the maximum heating state, and the original screen set temperature displays "Hi" (**AUTO** and temperature unit symbol are not displayed).
- The following may be output forcibly when in maximum heating state:
 1. Temperature damper to full hot position
 2. Mode damper switches to FOOT position only in automatic mode, and does not change in manual mode
 3. Circulation damper, blower air volume becomes the maximum volume
- When in maximum heating operation state, exit the state only when receiving the command of temperature decreasing. **ATCECU** exits the HI mode when restarting, to ensure the comfortable of the automatic air conditioner, and the set temperature of the screen returns to 28°C.

A/C Switch Button

- When pressing the button, the compressor will be turned on, and the **LCD** displays **A/C** symbol, when pressing this button again, the compressor will be turned off, and the **A/C** symbol on the **LCD** disappears.
- In **AUTO** state, if pressing the **A/C** button, **AUTO** symbol disappears, the compressor enters manual control, and other devices keep automatic controls.

Air Speed Adjusting Knob - Air Speed Increases, Air Speed Decreases

- Blower air speed has 8 levels in total when adjusted manually by users, a pattern displays on screen respectively each time the blower range switches.
- Rotate the knob clockwise, blower speed increases, and rotate the knob counterclockwise, blower speed decreases.
- When the air speed is adjusted to the maximum, the speed up command is received and refused to accept, and the original state is kept on the display of the screen, when the lowest speed level is 1, the speed down command is received and refused to accept at this time, and the original state is kept on the display of the screen.
- In **AUTO** state, if rotating the knob, the **AUTO** symbol is canceled, air speed enters manual control, and other devices keep automatic controls.
- When rotating the knob with air conditioning system off, the system turns on and all equipments return to the state before the system turns off.

Mode Button

- Press the mode button, mode damper switches among Face ® Face/Foot ® Foot ® Foot/Defrost ® Defrost ® Face, and displays the corresponding pattern on the screen.
- In **AUTO** state, if pressing the button, the **AUTO** symbol is canceled, mode damper enters manual control, and other devices keep automatic controls.
- When in Foot/Defrost or Defrost mode, circulation damper switches to outer circulation, **A/C** turns on automatically, however, the display of the screen keeps the original state of **A/C**. When the ambient temperature is 3°C or less, the defrosting volume level is 8, when the ambient temperature is more than 3°C, the defrosting volume level is 6.

Max. Front Defrost Button

- Press the Max. front defrost button, the screen displays defrost symbol, the Max. front defrost button indicator turns on and the system enters the Max. front defrost control state. At this time, **A/C** turns on automatically, however, the display of the screen keeps the original state of **A/C**.
- If the Max. front defrost button is pressed again, the Max. front defrost state will be exited, and return to the previous state. The Max. front defrost indicator goes off.
- When air conditioning system is off, press the button, the system turns on and enters the Max. front defrost state.
- When the ambient temperature is 3°C or more, it is the Max. defog and the air speed is set to level 6, and when the ambient temperature is less than 3°C, it is the Max. defrost and the air speed is set to level 8.

Rear Defrost Button

Rear window heating button is not related to the air conditioning system, which can complete the relative functions individually. Every time the button is pressed, **BCM** will receive a low pulse signal with 200 ms pulse width once. After receiving the low signal feedback by rear window heater, **LED** indicator will turn on and the heating mark will be displayed on the display.

Inner Circulation Button

- Press the inner circulation button, circulation damper switches to inner circulation and displays on screen accordingly.
- When reverse signal and wash signal are effective, circulation damper switches to inner circulation, and when reverse and wash signals are invalid, circulation damper returns to the previous state.

- When reverse signal and wash signal are effective, if the manual outer circulation request is received, circulation damper switches to outer circulation.
- Defog/defrost has high priority, when in defrost/defog state, reverse or wash signal that received by the system is considered as invalid signal.
- When the reverse signal and washer signal are invalid and the system is continuously in the inner circulation, the system switches to the outer circulation automatically after 16 minutes, and if the inner circulation request still exists after 30 seconds, it returns to the inner circulation again, but the display on the screen is not changed.
- In **AUTO** state, press the button, and the **AUTO** symbol is canceled, the inner and outer circulations enter the manual control, and other devices keep the automatic controls.

Outer Circulation Button

- Press the outer circulation button, the circulation damper switches to the outer circulation and displays on screen accordingly.

- If the button is pressed in **AUTO** state, the **AUTO** symbol is canceled, the inner and outer circulations enter the manual control, and other devices keep the automatic controls.

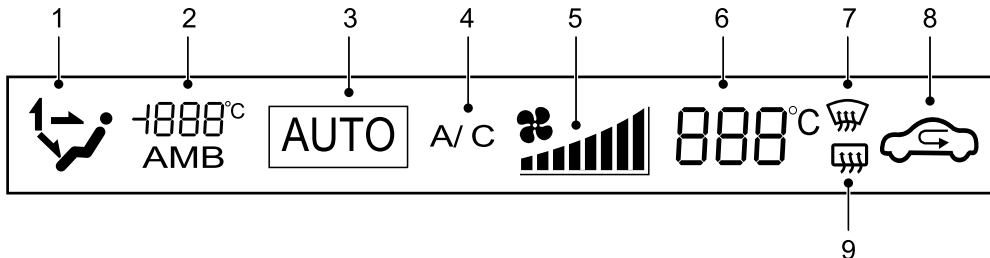
Celsius/Fahrenheit Switch Button

This is a combination button, and consists of mode button and rear window heating button. Press the combination button for 3 seconds simultaneously when receiving the valid command from it, which complete the switching between Celsius and Fahrenheit for the ambient temperature and the set temperature, and meanwhile the corresponding change of °C and °F is displayed on the **LCD** display.

System Close Button - OFF Button

If the button is pressed when the air conditioning system is on, the system devices are closed (blower and compressor stop operating, damper actuator continuously run to the required position and stay there, and only the ambient temperature and inner and outer circulation states are displayed on the screen).

Display Output - Automatic Air Conditioner (ATC)



- | | |
|--------------------------|--------------------------------------|
| 1. Air Distribution Mode | 6. Room Set Temperature |
| 2. Ambient Temperature | 7. Defrost Mode |
| 3. Automatic Mode | 8. Inner/Outer Circulation Switching |
| 4. A/C ON | 9. Heated Rear Windshield (HRW) |
| 5. Blower Speed | |

When the related functions of the system are activated, the symbols and words on the display are illuminated. When the exterior illumination is off or on, the output brightness of the **ATCLCD** display is adjusted accordingly.

Temperature:

Displays the external ambient temperature and room temperature.

Inner/Outer Circulation Indication:

The inner circulation indicator comes on when the system is in inner circulation state, and the outer circulation indicator comes on when the system is in outer circulation state.

Automatic Mode:

When the inlet source, blower speed, air distribution or compressor operates in the automatic mode, the **AUTO** symbol and the related symbols above are illuminated.

Manual Air Distribution:

The corresponding outlet mode symbol is illuminated to display the manual selected air distribution. The outlet mode symbol turns off in the automatic mode.

Blower Speed:

Select the blower speed manually from the range of 1 to 8 in order to perform manual adjustment.

Air Conditioning Pressure Switch

Air conditioning pressure switch protects the refrigeration system from being applied the limit pressure and helps controlling the engine cooling fan speed. The pressure switch is fitted on the high temperature/high pressure air conditioning tube located in the rear of the engine bay between the condenser and **TXV**. This switch outputs the pressure signal to **ECM**.

Evaporator Temperature Sensor

Evaporator temperature sensor is a **NTC** type sensor, and provides the evaporator surface temperature input for **ATC ECU**. Evaporator temperature sensor is located at the outlet side of the evaporator core in the heater assembly.

Room Temperature Sensor

Room temperature sensor is a **NTC** type sensor, and provides the passenger compartment air temperature input for **ATC ECU**. The sensor is integrated in the **ATC ECU**.

Solar Sensor

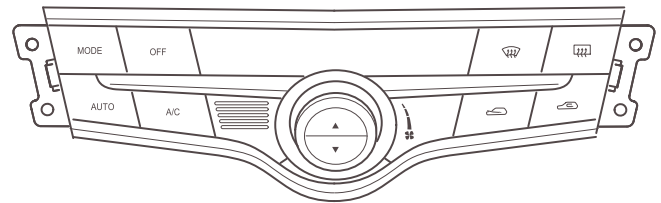
The sensor is fitted on the left side of the instrument panel near the front windshield. The solar sensor consists of a single diode that inputs the light level to the **ATC ECU**, and the input is used to measure the solar heating effect acting on the passengers' body.

Heater Core Coolant Temperature Sensor

The heater core coolant temperature sensor is a **NTC** type sensor, and provides the related heater core coolant temperature input for **ATC ECU**. The sensor is fitted on the passenger side of the heater case and pressed under the heater core.

Ambient Temperature Sensor

The ambient temperature sensor is secured on the front bumper longitudinal member. **ATCECU** obtains the ambient temperature signal by using the sensor signal to compensate the room air temperature.

Control Panel

The control mechanism for the warm air and ventilation is fitted on the panel in the centre of the instrument panel, and the control panel is also formed as a part of air conditioner (**A/C**) **ECU**. The temperature adjusting button controls the room outlet temperature, blower speed knob controls the blower speed, one mode button switch controls the air distribution, two button switches control the selection of the fresh/circulation air and the operations of the front windshield defroster and heated rear windshield (**HRW**) respectively. When pressing the above switches respectively, the corresponding symbols on the **LCD** are illuminated.

The symbols on the panel and control switch indicate the operating position and function of each function module.

Operation

General Description

To operate the air conditioning system, **ATCECU** communicates with **ECM**, and **ECM** controls the compressor clutch engagement and engine cooling fan speed. **ATCECU** also controls the operations of servomotor on heater, blower speed, air temperature and air distribution.

Blower Control

The blower relay supplies battery power to the blower to produce the different blower operating voltage and speed. The blower control module can mostly supply the whole battery voltage to blower to make it operate at the maximum speed.

Air Temperature

The damper servomotor on the HVAC module assembly is controlled by the temperature button on the control panel. The mix damper changes the rate of air that flows through the bypass and the heater core. The ratio varies between all bypasses with no warm air and no bypasses with all warm air to match the positions of the rotary switch.

Air Distribution

The mode damper servomotor is operated to turn the air distribution damper in the HVAC module assembly by using the air distribution switch on control panel in order to guide the air into the respective outlet around passenger compartment.

Compressor Clutch Relay

When the main relay is on, the A/C compressor clutch relay coil can be activated. The relay coil ground is controlled by **ECM**, and it completes ground after receiving the air conditioning opening request information.

Malfunction

If a malfunction occurs in the A/C compressor clutch relay, the following conditions will be seen:

- The clutch does not engage with the compressor pulley (visual check)
- The inlet air temperature does not decrease

The following malfunctions may be occur in A/C compressor clutch relay:

- Relay Coil Short
- Relay Coil Open
- High Relay Coil Resistance
- Relay Contact Point Remains Open
- Relay Contact Point Remains Close
- High Relay Contact Point Resistance
- Relay Wire Open
- High Relay Wire Resistance

- Relay Wire Shorted to 12 V Power
- Relay Wire Shorted to Ground
- **ECM** does not Provide Ground

If the A/C compressor clutch is not engaged, however, air conditioner switch is in "ON" position, remove the compressor clutch relay and perform the test.

Check if the ECM provides the ground route for the relay to supply power. Connect the multimeter between the 12 V power source and the 85-pin which is on the fuse box terminal and corresponds to the relay. When starting the engine and turning on the air conditioning system, the multimeter should indicate 12 V. If the ground is not provided by ECM, please check if the connection conditions are met. Check the wire resistance between the relay contact point and the compressor clutch. Remove the relay, and measure the resistance between the 87-pin which is on the fuse box terminal and corresponds to the relay and the compressor clutch. The resistance value should be less than 0.5Ω.

Blower Control

The blower speed can be controlled by manual selection or automatic control. The blower speed can be calculated by the following inputs:

- Ambient Temperature
- Temperature Difference of Outside Control Circuit
- Set Temperature
- Battery Voltage
- Blower Feedback Voltage

The blower relay and power tube are used to operate the blower at one speed among 8 gear speeds. When the heater control is in automatic mode, all the speed gears can be used. In manual mode, 8 gear speeds are used to provide low speed, middle speed and high speed for the heater. The blower relay is powered by the battery and grounded by **ATCECU**, **ATCECU** adjusts the voltage of blower motor through power tube to control the blower speed.

ATC System Control

ATC system is a close loop control system, aiming to realize the comfortable climate in the passenger compartment. To achieve the purpose, the system will maintain both the following conditions:

- Temperature Distribution from Floor to Roof
- Average Temperature in Passenger Compartment

The aim of the system is to realize the temperature distribution of the higher floor temperature and the lower roof temperature by the following inputs:

- Set the Temperature of Passenger Compartment According to the User's Selection

- Room Temperature
- Ambient Temperature
- Evaporator Temperature
- Heater Core Coolant Temperature

The following outputs are obtained after these inputs are processed by **ATC ECU**:

- Mix Damper Servomotor Position
- Mode Damper Servomotor Position
- Blower Speed

When turning on the system for the first time, **ATCECU** continues to use the control output used in last time the system is off. If the conditions are changed or the different modes are selected to turn on the system, the control output is changed immediately to produce the desired new setting.

When the system is operating in automatic mode and defrosting mode, the inlet source, blower speed and air distribution can be set manually to ignore the automatic control. The air temperature is controlled automatically in any operation mode.

In automatic mode, **ATCECU** operates the system to heat or cool the passenger compartment in order to create and maintain the temperature selection on the control panel, at the same time, the air is guided to the outlet which is most comfortable for the passenger.

When the system is in automatic mode or defrosting mode and the A/C compressor is turned off manually, **ATCECU** enters the economic mode to reduce the load of engine. The operation of the economic mode is similar to the automatic mode, but the passenger compartment cannot be cooled when the ambient temperature is higher than the temperature selected on control panel, or the fresh air or recirculation air cannot be dehumidified.

In defrosting mode, **ATCECU** sets the inlet source to fresh air, the blower speed to maximum, air distribution to front windshield and front side window, and outputs signal to **BCM** to operate the rear windshield heater.

When the fresh/recirculation air switch is pressed, the fresh/recirculation air damper determines the inlet source is fresh air outside of the vehicle or recirculation air used in passenger compartment. **ATCECU** controls this damper in the following two positions:

- Fresh Air Side
- Recirculation Air Side

Compressor Control

When the system detects that the request has been changed into turning on the compressor, **ECM** makes the compressor clutch relay energize to supply the battery power supply to

the compressor clutch, but this is based on the existence of the following conditions:

- The pressure switch is grounded to **ECM**.
- The evaporator temperature is over 3.5°C.
- The acceleration of the engine is not difficult.
- The engine coolant temperature is not too high.
- There is no engine running problem.

If one of the permissible conditions is not met, **ECM** will cut off the power supply of the compressor clutch relay and disengages the compressor clutch until the permissible condition resumes. If the compressor clutch disengages due to hard acceleration, **ECM** will ignore the hard acceleration recurred and the compressor clutch will keep engaged after this condition occurs three times in a single ignition cycle.

When the request from compressor is received by the system, **ECM** outputs the compressor clutch state to **ATCECU** to judge if the request should be permitted. If the compressor request is permitted by the conditions, **ATCECU** keeps the air conditioning symbol indicator illuminating. If the condition does not permit, the system refuses the compressor request, and **ATCECU** repeats the compressor request until it is permitted or cancelled by the following manners:

- Press the air conditioning switch again to turn off the compressor.
- Select the blower OFF to turn off the compressor.
- Remove the ignition key.

When the compressor is engaging:

- If the inlet air, heater speed and air volume distribution are in automatic mode, illuminate the **AUTO** symbol

Once the requested compressor is permitted, the compressor keeps operating until the request is cancelled or the engine stops even if one of the permitted conditions does not exist.

Air Temperature Control

To determine the heating volume or cooling volume required in the passenger compartment, **ATCECU** uses the sensor input temperature and selected temperature on the control panel to calculate the target temperature of outlet on the heater assembly driver side and front passenger side. Then, **ATCECU** sends the signal to servomotor, and allows it to control the mix damper on the heater assembly to move the damper to an appropriate position. The target temperature updates continuously, and is used for the further calculation to determine the blower speed and air distribution in the automatic mode.

The average temperature of the passenger compartment is adjusted according to the ambient temperature. If the surrounding air temperature is too low, the average vehicle interior temperature is increased. If the surrounding

air temperature is too high, the average vehicle interior temperature is increased slowly.

The signal provided by solar sensor is served as the compensation to control algorithm, so that the passenger compartment reaches the comfortable temperature even if the sunshine loads. The compensation is effective only when the air distribution is set to Face position or Face/Foot position, as the passenger could feel the compensation best in these positions.

Air Distribution Control

In order to control the air distribution in the passenger compartment, **ATCECU** sends the signal to servomotor, and allows it to control the distribution damper in the heater assembly to move the damper to an appropriate position.

Default Setting

If the battery power supply of **ATCECU** is off due to some reasons (such as battery disconnection), the system will return

to default setting when the battery power supply is reinstated. The default setting is:

- Temperature range is 16°C–28°C
- Outlet temperature is 22°C

After the battery power supply is reinstated, the automatic mode will be activated if the system is turned on with OFF switch for the first time, regardless of what kind of setting is used when the battery is disconnected.

Diagnosis

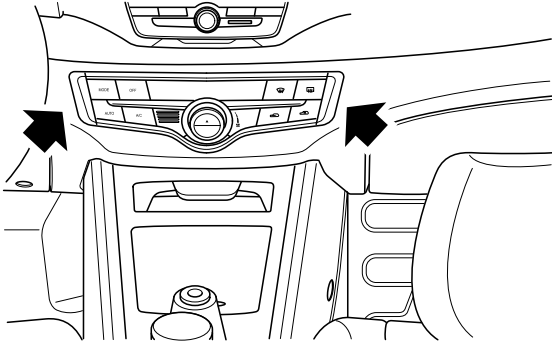
Each time the ignition switch is turned on, **ATCECU** will perform the diagnostic check and store the Diagnostic Trouble Codes (**DTC**) corresponding to the malfunctions (if have) in **ATC ECU**. Then, **ATCECU** returns to normal control, but it uses the default value or default strategy to correspond to the detected malfunction. **DTC** can be read by scan tool. Other malfunctions can be determined by performing manual diagnostic check on the system.

Service Procedures

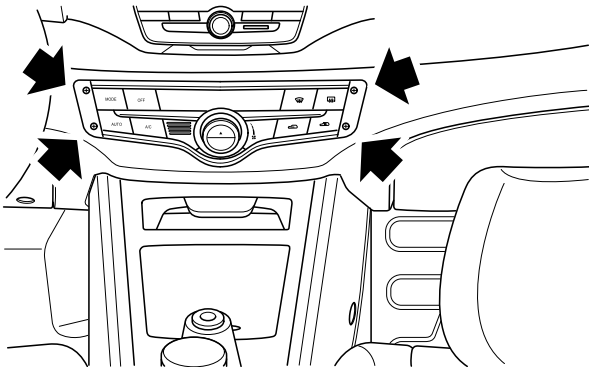
Air Conditioner Controller Assembly - ATC

Removal

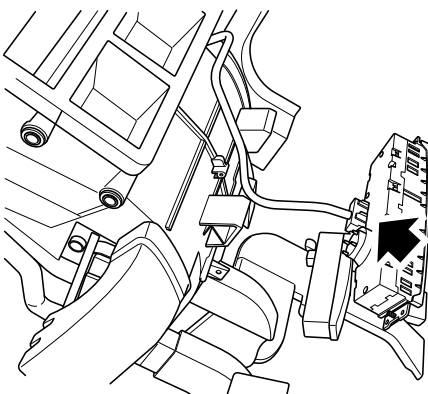
1. Disconnect the battery earth lead.
2. Remove the air conditioner controller assembly trim.



3. Remove the air conditioner controller assembly tightening screw.



4. Take the air conditioner controller assembly out forward.
5. Disconnect the electrical connector joint from rear and remove the air conditioner controller assembly.



Refit

1. Connect the air conditioner controller assembly electrical connector.
2. Fit the air conditioner controller assembly to instrument panel.
3. Fit air conditioner controller assembly tightening screw, and tighten it to **2.5-3 Nm**.
4. Fit the air conditioner controller assembly trim.
5. Connect the battery earth lead.

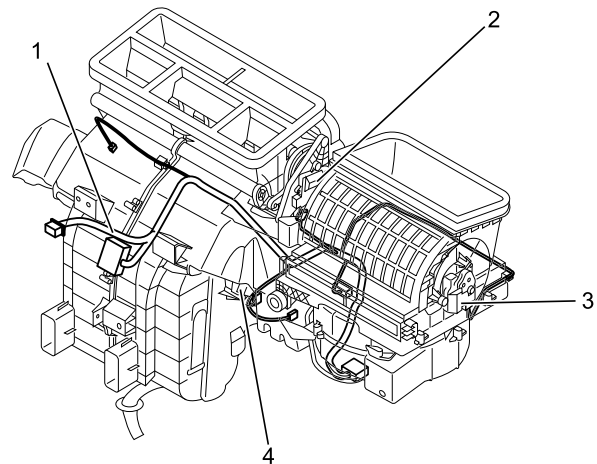
Temperature Damper Actuator

Removal

1. Disconnect the battery earth lead.
2. Remove the glove box assembly.

Glove Box Assembly Removal

3. Remove the HVAC module foot duct RH.
4. Disconnect the temperature damper actuator electrical connector.
5. Remove the temperature damper actuator tightening screw (4).



6. Remove the temperature damper actuator.

Refit

1. Fit the temperature damper actuator.
2. Fit the temperature damper actuator tightening screw and tighten it to **1-2 Nm**.
3. Connect the temperature damper actuator electrical connector.
4. Fit the HVAC module foot duct RH.
5. Fit the glove box assembly.

Glove Box Assembly Refit

6. Connect the battery earth lead.

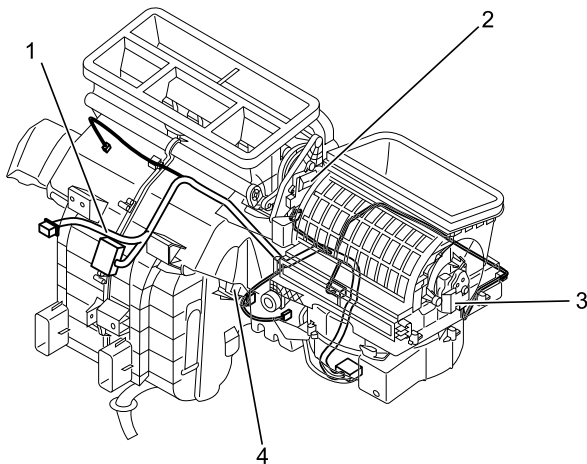
Mode Damper Actuator

Removal

1. Disconnect the battery earth lead.
2. Remove the glove box assembly.

 **Glove Box Assembly Removal**

3. Remove the HVAC module foot duct RH.
4. Disconnect the mode damper actuator electrical connector.
5. Remove the mode damper actuator tightening screw (2).



6. Remove the mode damper actuator.

Refit

1. Fit the mode damper actuator.
2. Fit the mode damper actuator tightening screw and tighten it to **1-2 Nm**.
3. Connect the mode damper actuator electrical connector.
4. Fit the HVAC module foot duct RH.
5. Fit the glove box assembly.

 **Glove Box Assembly Refit**

6. Connect the battery earth lead.

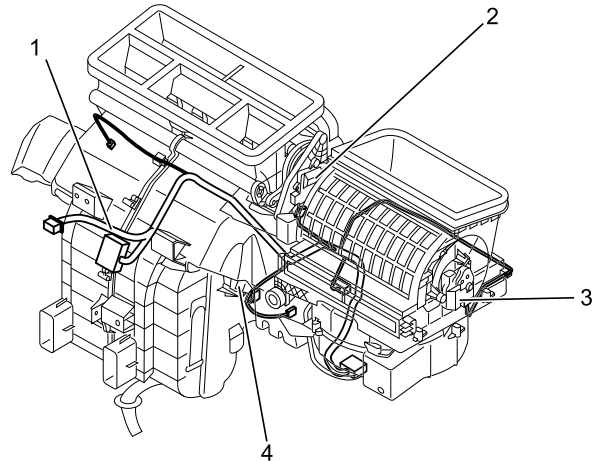
Inner/Outer Recirculation Damper Actuator

Removal

1. Disconnect the battery earth lead.
2. Remove the glove box assembly.

 **Glove Box Assembly Removal**

3. Disconnect the inner/outer recirculation damper actuator electrical connector.
4. Remove the inner/outer recirculation damper actuator tightening screw (3).



5. Remove the inner/outer recirculation damper actuator.

Refit

1. Fit the inner/outer recirculation damper actuator.
2. Fit the inner/outer recirculation damper actuator tightening screw and tighten it to **1-2 Nm**.
3. Connect the inner/outer recirculation damper actuator electrical connector.
4. Fit the glove box assembly.

 **Glove Box Assembly Refit**

5. Connect the battery earth lead.

Evaporator Core Temperature Sensor**Removal**

1. Disconnect the battery earth lead.
2. Remove the HVAC module assembly.

 HVAC Module Assembly Removal

3. Remove the upper evaporator case tightening screw on HVAC module.
4. Remove the upper evaporator case on HVAC module.
5. Remove the evaporator core temperature sensor from the evaporator.

Refit

1. Fit the evaporator core temperature sensor to evaporator and the mounting position must be the same as the original.
2. Fit the upper evaporator case on HVAC module.
3. Fit the upper evaporator case tightening screw on HVAC module.
4. Fit the HVAC module assembly.

 HVAC Module Assembly Refit

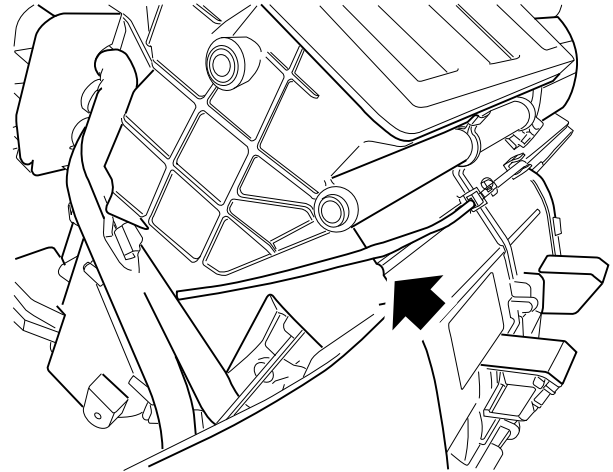
5. Connect the battery earth lead.

Heater Core Temperature Sensor**Removal**

1. Disconnect the battery earth lead.
2. Remove the upper instrument panel assembly.

 Upper Instrument Panel Assembly Removal

3. Disconnect the heater core temperature sensor electrical connector.



4. Remove the heater core temperature sensor from the heater core inlet and outlet pipe.

Refit

1. Fit the heater core temperature sensor to heater core inlet and outlet pipe.
2. Connect the heater core temperature sensor electrical connector.
3. Fit the upper instrument panel assembly.

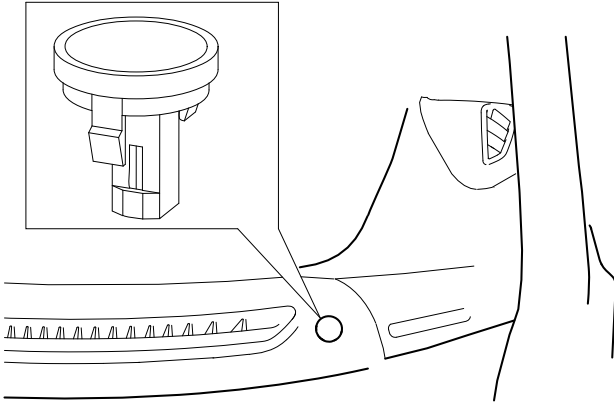
 Upper Instrument Panel Assembly Refit

4. Connect the battery earth lead.

Solar Sensor

Removal

1. Disconnect the battery earth lead.
2. Using a screwdriver, pry out the solar sensor from instrument panel.



3. Disconnect the electrical connector of solar sensor, and avoid the joint dropping below the instrument panel.
4. Remove the solar sensor.

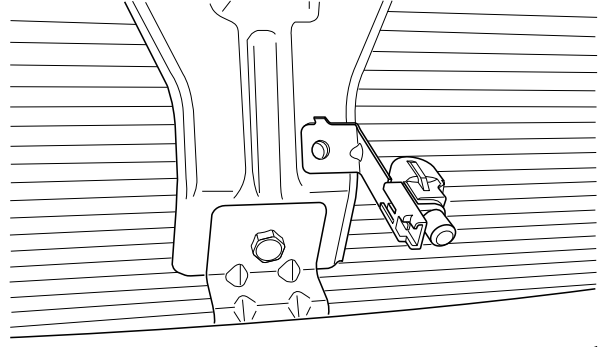
Refit

1. Connect the electrical connector of solar sensor.
2. Fit the solar sensor to the instrument panel and lock it in position with clips.
3. Connect the battery earth lead.

Ambient Temperature Sensor

Removal

1. Disconnect the battery earth lead.
2. Remove the front grille assembly.
3. Remove the ambient temperature sensor set screw.



S102011

4. Remove the ambient temperature sensor.

Refit

1. Fit the ambient temperature sensor.
2. Fit the ambient temperature sensor set screw, and tighten it to **5-7 Nm**.
3. Fit the front grille assembly.
4. Connect the battery earth lead.

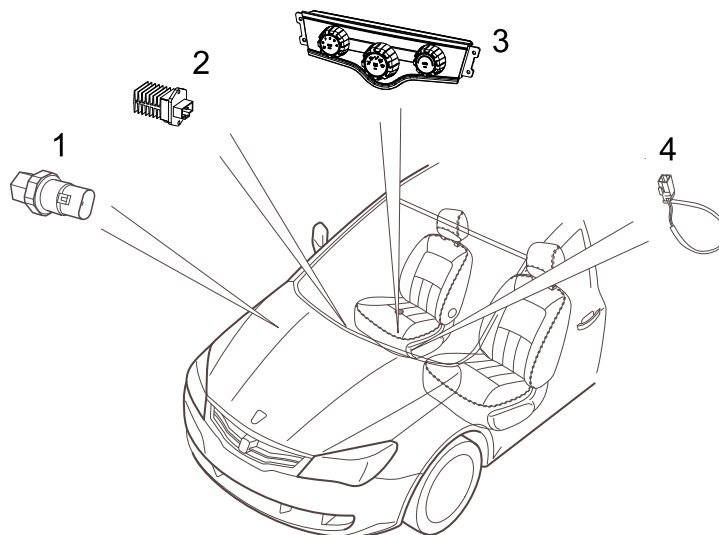
HVAC-ETC
Specifications
Torque

| Description | Value |
|---|------------|
| Screw - Air Conditioner Controller Assembly | 2.5-3.0 Nm |

Description and Operation

System Component Layout

Air Conditioner Control System Component Layout - Electronic Air Conditioner (ETC)



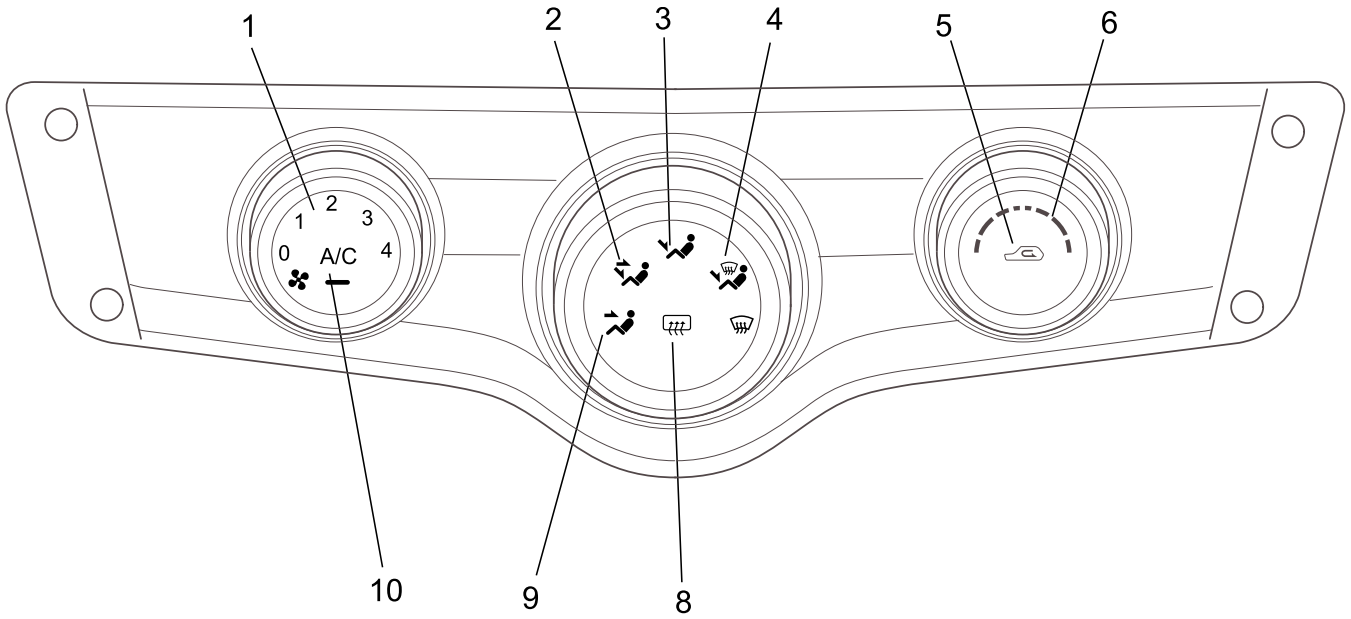
1. Air Conditioning Pressure Switch

2. Blower Governor Resistor

3. ETC Controller Assembly

4. Evaporator Temperature Sensor

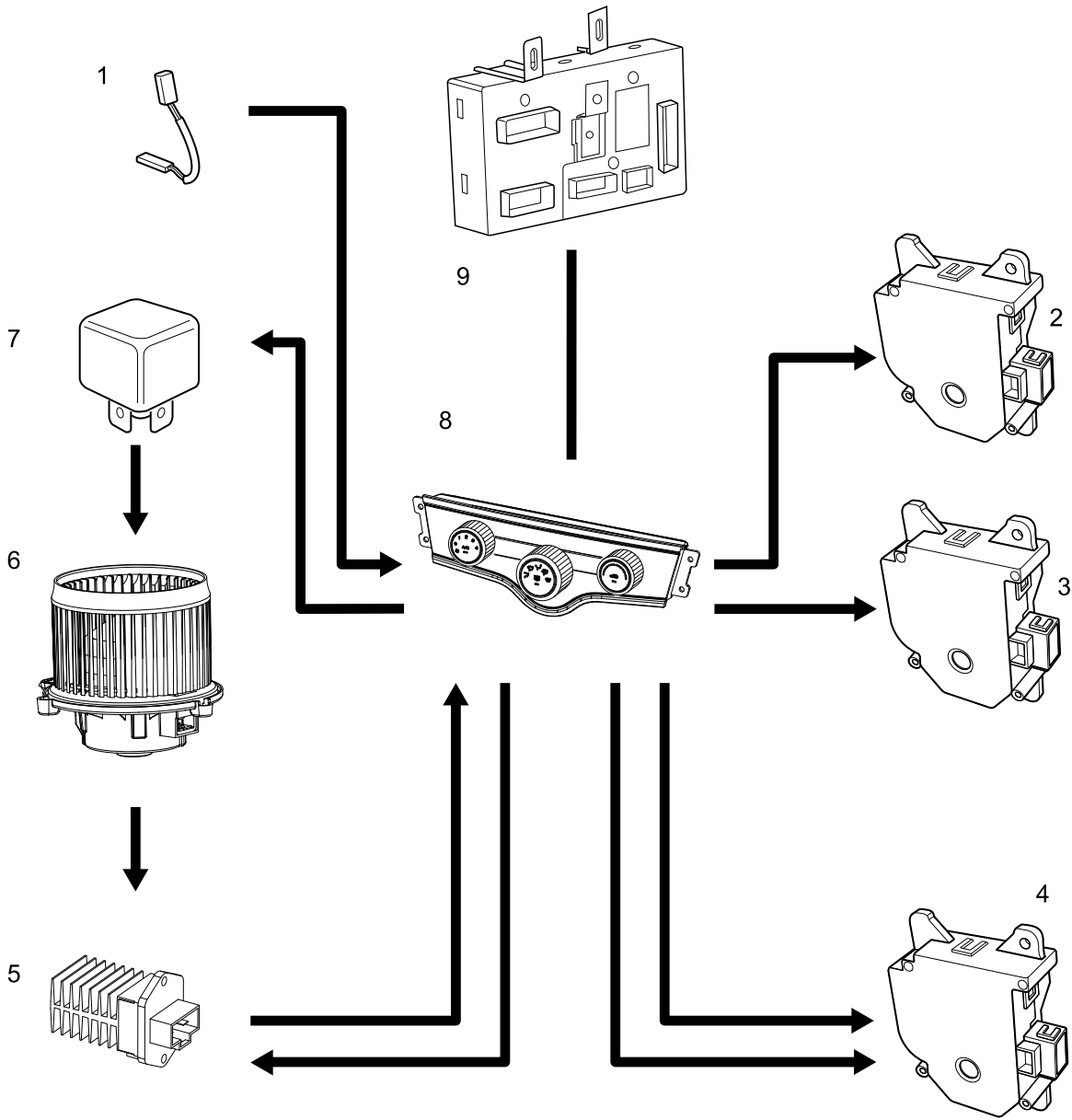
Control Panel – Electronic Air Conditioner (ETC)



- | | |
|-----------------------|----------------------|
| 1. Air Volume Knob | 6. Temperature Level |
| 2. FACE + FOOT Mode | 7. Defrost Mode |
| 3. FOOT Mode | 8. HRW Button |
| 4. FOOT + Window Mode | 9. FACE Mode |
| 5. REC Button | 10. A/C Button |

System Control Diagram

Heater Assembly Control Diagram - Electronic Air Conditioner (ETC)

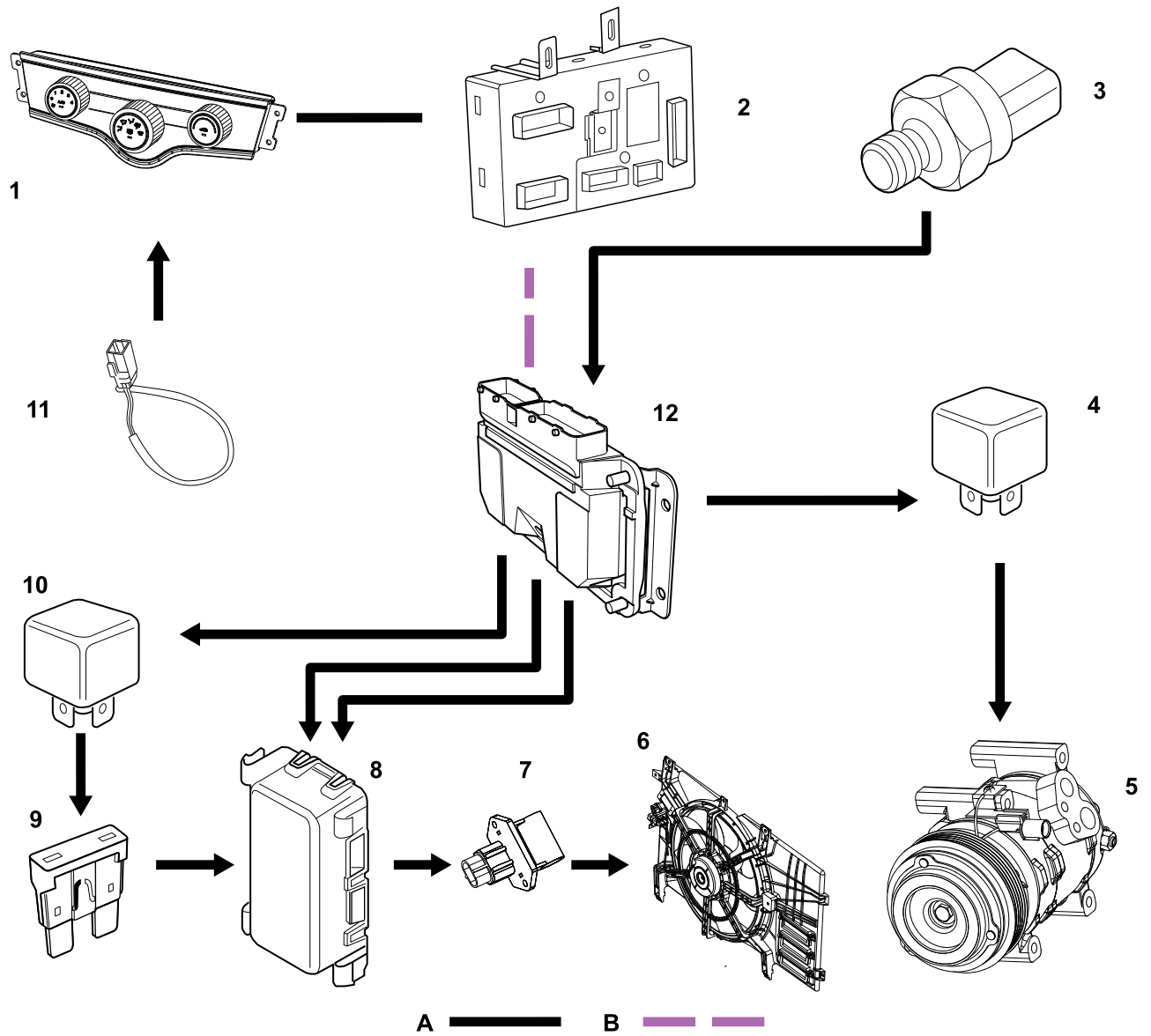


A ———

A = Hard Wire

- | | |
|--|----------------------------|
| 1. Evaporator Temperature Sensor | 6. Blower |
| 2. Mode Damper Servomotor | 7. Blower Relay |
| 3. Mix Damper Servomotor | 8. ETC Controller Assembly |
| 4. Fresh/Circulation Air Damper Servomotor | 9. BCM |
| 5. Blower Governor Resistor | |

Compressor and Cooling Fan Control Diagram -
Electronic Air Conditioner (ETC)



A = Hard Wire; B = CAN Bus Line

- | | |
|-------------------------------------|-----------------------------------|
| 1. ATC Controller Assembly | 7. Cooling Fan Low Speed Resistor |
| 2. BCM | 8. Cooling Fan Relay Unit |
| 3. Air Conditioning Pressure Switch | 9. Cooling Fan Relay Unit Fuse |
| 4. A/C Compressor Relay | 10. Main Relay |
| 5. A/C Compressor | 11. Evaporator Temperature Sensor |
| 6. Cooling Fan | 12. ECM |

Description

General Description

In the electronic controlled air conditioning system, functions are selected manually, such as air inlet, air temperature, air distribution and blower speed, etc.

Control System - Electronic Air Conditioning System (ETC)

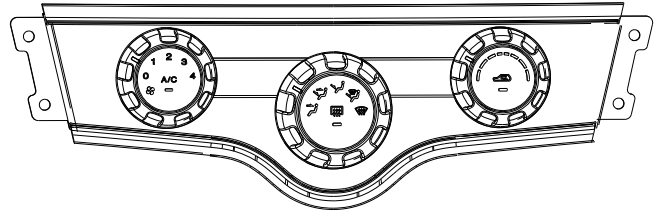
ETC control system consists of the following:

- **ETC ECU**
- Air Conditioning Pressure Switch
- Evaporator Temperature Sensor
- Blower Governor Resistor

ETC ECU

ETCECU and **BCM** are connected by hard wires to control the rear windshield heater.

Control Panel



The air conditioning system controls the air temperature and distribution in the vehicle. The system contains the following parts: air conditioner filter, HVAC module assembly, distribution piping and controller assembly. The outlet is integrated in the boot.

Icons on the panel and control switch indicate the respective operating position and function.

Operation

General Description

To operate the air conditioning system, **ATCECU** communicates with **ECM**, and **ECM** controls the compressor clutch engagement and engine cooling fan speed. **ATCECU** also controls the operation of servomotor on the HVAC module assembly, blower speed, air temperature and air distribution.

Blower Control

The air volume knob on the **ETC** controls the blower speed, and the air speed level on the knob is 0 to 4.

When the IGN is turned on, the air volume knob can be used to control the operation state of **ETC**. If the air volume knob indicator indicates level 0, it means that **ETC** is turned off, if it indicates the levels other than level 0, it means that **ETC** is turned on. The blower speed is determined by the position of the knob.

The blower speed is divided into 5 levels, level 0, 1, 2, 3 and 4 respectively. The air speed increases step by step. The level of the air speed is indicated by the air volume knob.

If the air volume knob indicates level 0, it means that no air is blown from the blower and **ETC** is turned off. At this time, **A/C** cannot send a request, however, the mode knob, temperature knob, REC button and **HRW** button can be operated independently. If the air volume knob indicator does not indicate level 0, it means that air is blown from the blower and **ETC** is turned on.

In the normal operation mode, when the blower knob is turned from level 1 to level 4 or from level 4 to level 1, the outlet mode, **A/C** state, **HRW** state, REC state and outlet air temperature are not affected, and only the air volume of the blower is changed.

In the front defrost mode, if the blower air volume is turned to level 0, the front defroster operation stops, the front defroster indicator goes off, **A/C** is turned off forcibly, and **ETC** is turned off. If the blower knob is turned from level 1 to level 4 or from level 4 to level 1, the air volume of front defroster changes according to the position indicated by the air volume knob without affecting the mode, **HRW**, **A/C**, REC and temperature state.

When the blower knob is turned from level 1 to level 0, **A/C** is turned off forcibly, the **A/C** indicator goes off, the front defroster is turned off and the front defroster indicator goes off. However, the control of mode knob, temperature knob, inner/outer recirculation button, **HRW** button and the state of respective indicator are not affected (If it was inner recirculation, the motor is in inner recirculation mode. If it was outer recirculation, the motor is in outer recirculation mode.).

Air Temperature

The mix damper servomotor on the HVAC module assembly is operated by turning the temperature rotary switch on the control panel. The mix damper changes the rate of air that flows through HVAC module bypass and heater core. The ratio varies between all bypasses with no warm air and no bypasses with all warm air to match the positions of the rotary switch.

Air Distribution

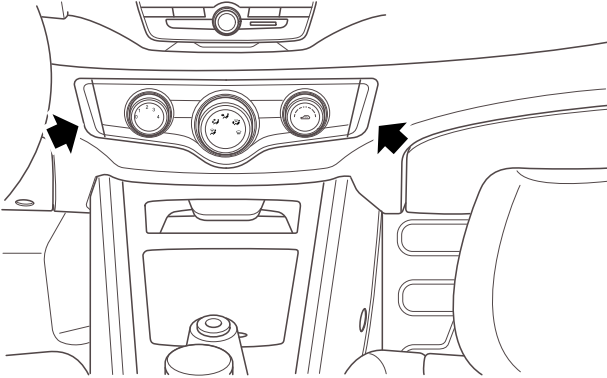
The mode damper servomotor is operated using the five air distribution knobs on the control panel to turn the air distribution damper in the HVAC module assembly and lead the air to the respective outlet around the passenger compartment.

Service Procedures

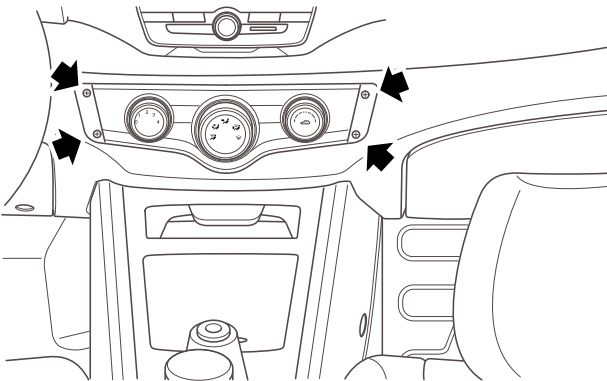
Air Conditioner Controller Assembly - ETC

Removal

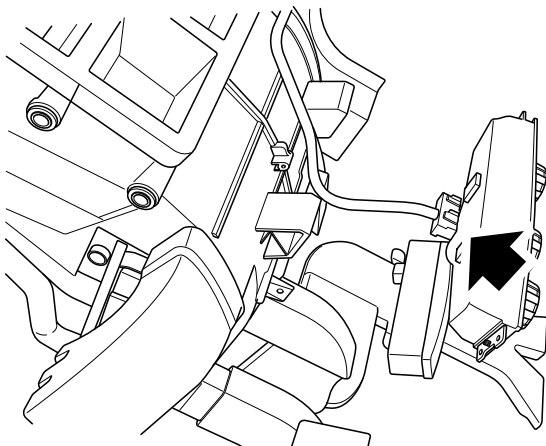
1. Disconnect the battery earth lead.
2. Remove the air conditioner controller assembly trim.



3. Remove the air conditioner controller assembly tightening screw.
4. Take the air conditioner controller assembly out forward.



5. Disconnect the electrical connector joint from the rear and remove the air conditioner controller assembly.



Refit

1. Connect the air conditioner controller assembly

electrical connector.

2. Fit the air conditioner controller assembly to the instrument panel.
3. Fit the air conditioner controller assembly tightening screws, and tighten them to **2.5-3.0 Nm**.
4. Fit the air conditioner controller assembly trim.
5. Connect the battery earth lead.

Front Wheel Steering

Specifications

Torque

| Description | Value |
|---|------------|
| Bolt - Power Steering Gear Inlet Tube to Power Assisted Steering Pump | 35-40 Nm |
| Nut - Steering Rod Ball Joint to Steering Arm | 35-40 Nm |
| Bolt - Steel On-Road Wheel Bolt | 115-130 Nm |
| Bolt - Steering Gear to Front Sub Frame | 100-130 Nm |
| Bolt - Steering Gear Return Tube to Steering Gear | 20-26 Nm |
| Bolt - Steering Gear Inlet Tube to Steering Gear | 20-26 Nm |
| Bolt - Steering Column to Steering Gear Input | 105-126 Nm |
| Bolt - Front Sub Frame Support Plate | 64-77 Nm |
| Nut - Anti Roll Bar Link to Anti Roll Bar | 40-60 Nm |
| Nut - Steering Rod to Steering Arm | 35-45 Nm |
| Bolt - Steering Column to Steering Gear Input Shaft | 18-25 Nm |
| Bolt - Power Assisted Steering Pump to Mounting Bracket | 19-25 Nm |

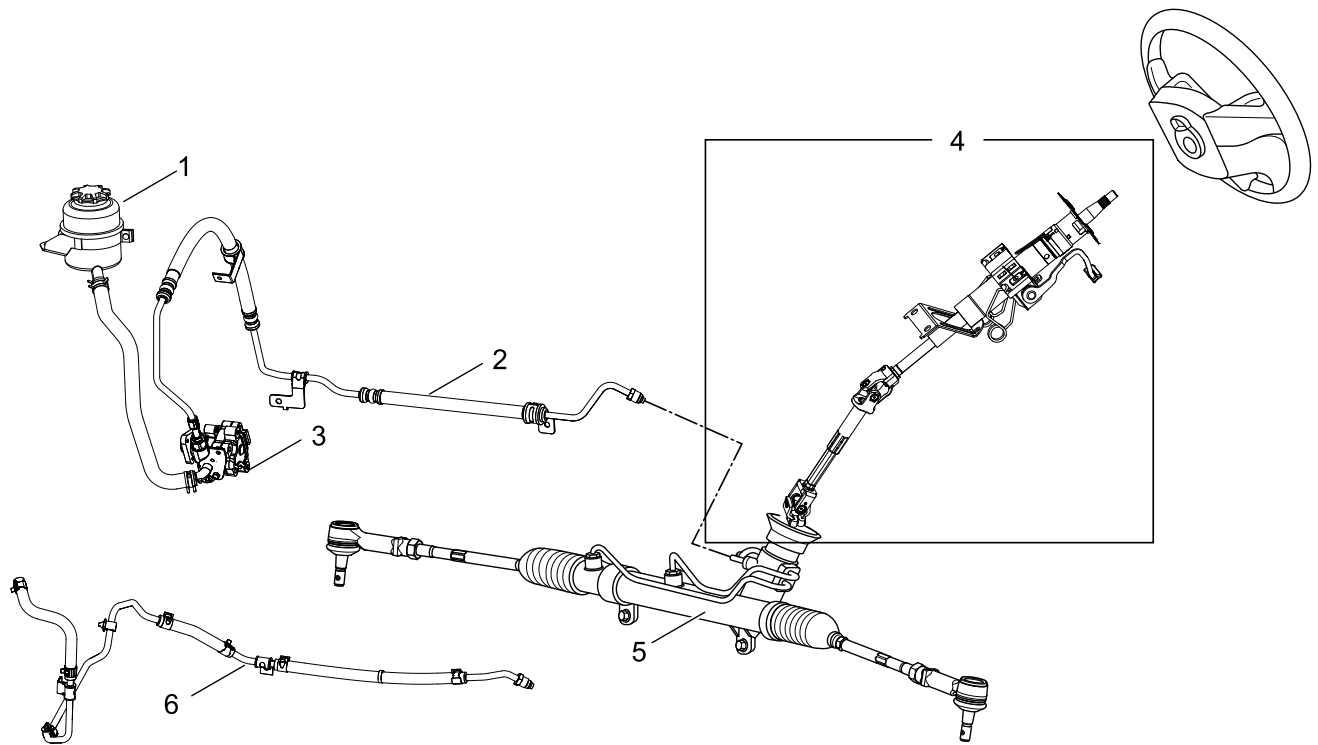
Parameter

| | |
|---|--|
| Type | Hydraulic servo assisted steering gear which can reach the linear gear ratio steering system |
| Steering Column: Type | Folding and energy absorbing type, the steering wheel can tilt up and down |
| Steering Wheel Diameter | 370 mm |
| Turns of Steering Wheel - Lock to Lock | 3 |
| Steering Circumference: Minimum Curve Radius | 11.3 m |
| Total Gear Ratio | 15.44: 1 |
| Power Assisted Steering: Operation Pressure: Flow: Nominal Value | 90 bar 6-7.5 L/Min. 7.5 L |

Description and Operation

System Component Layout

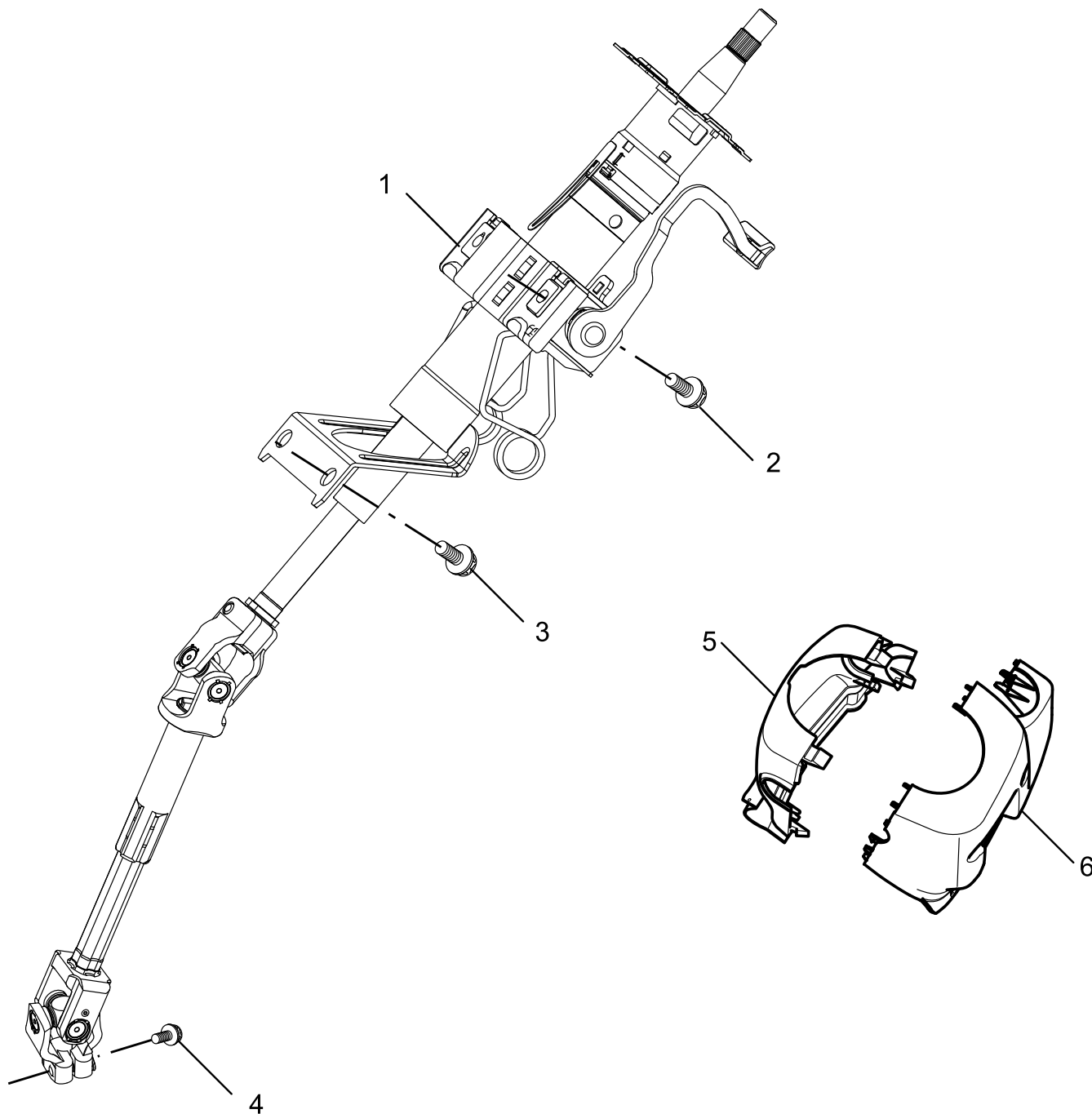
Steering System Component Layout



S382011

- | | |
|--|---------------------------------|
| 1. Power Steering Oil Reservoir Assembly | 4. Steering Column Assembly |
| 2. Steering Gear Inlet Tube | 5. Power Steering Gear Assembly |
| 3. Power Assisted Steering Pump | 6. Steering Gear Return Tube |

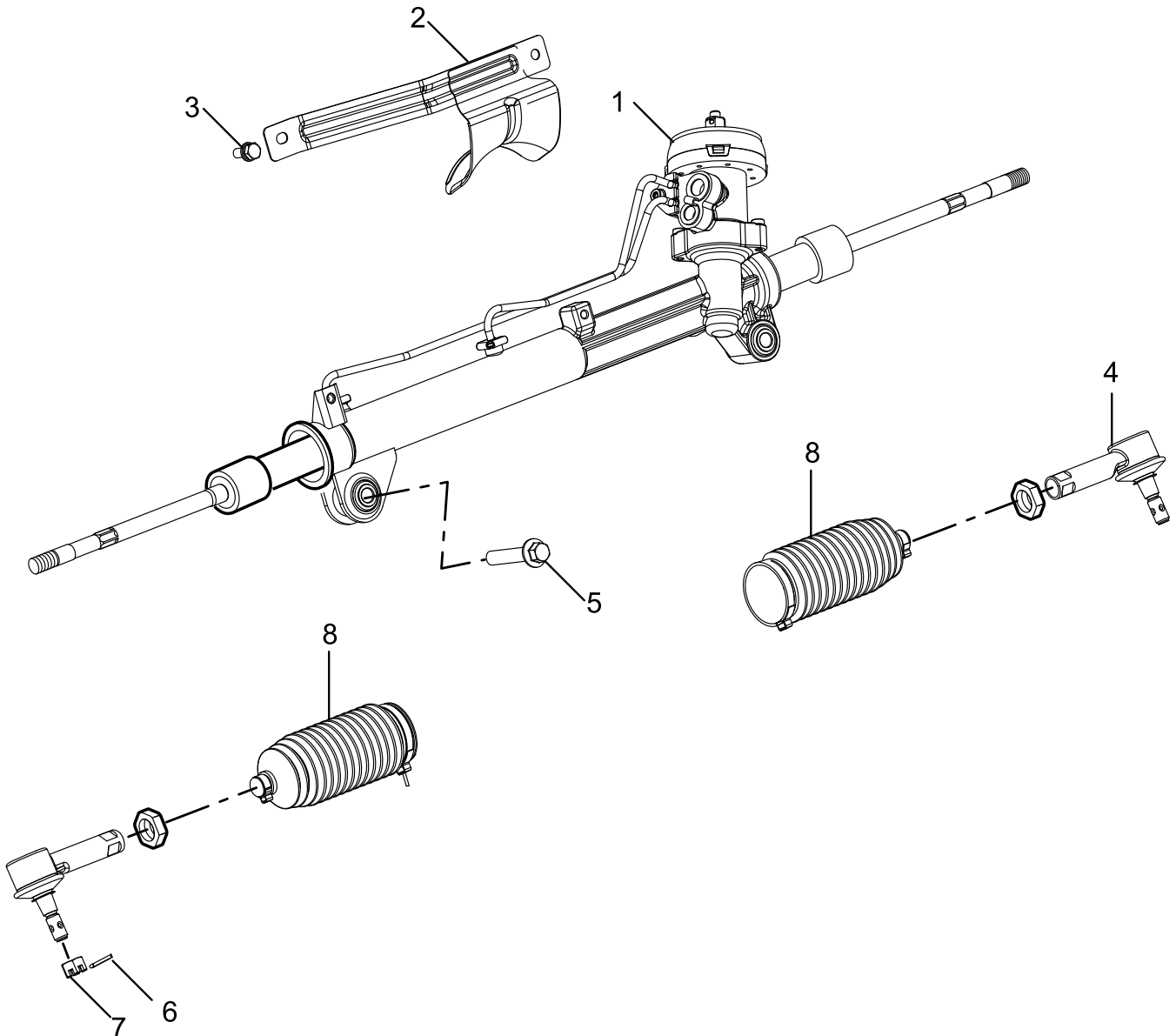
Steering Column Component Layout



- 1. Steering Column Assembly
- 2. Bolt (2)
- 3. Bolt (2)

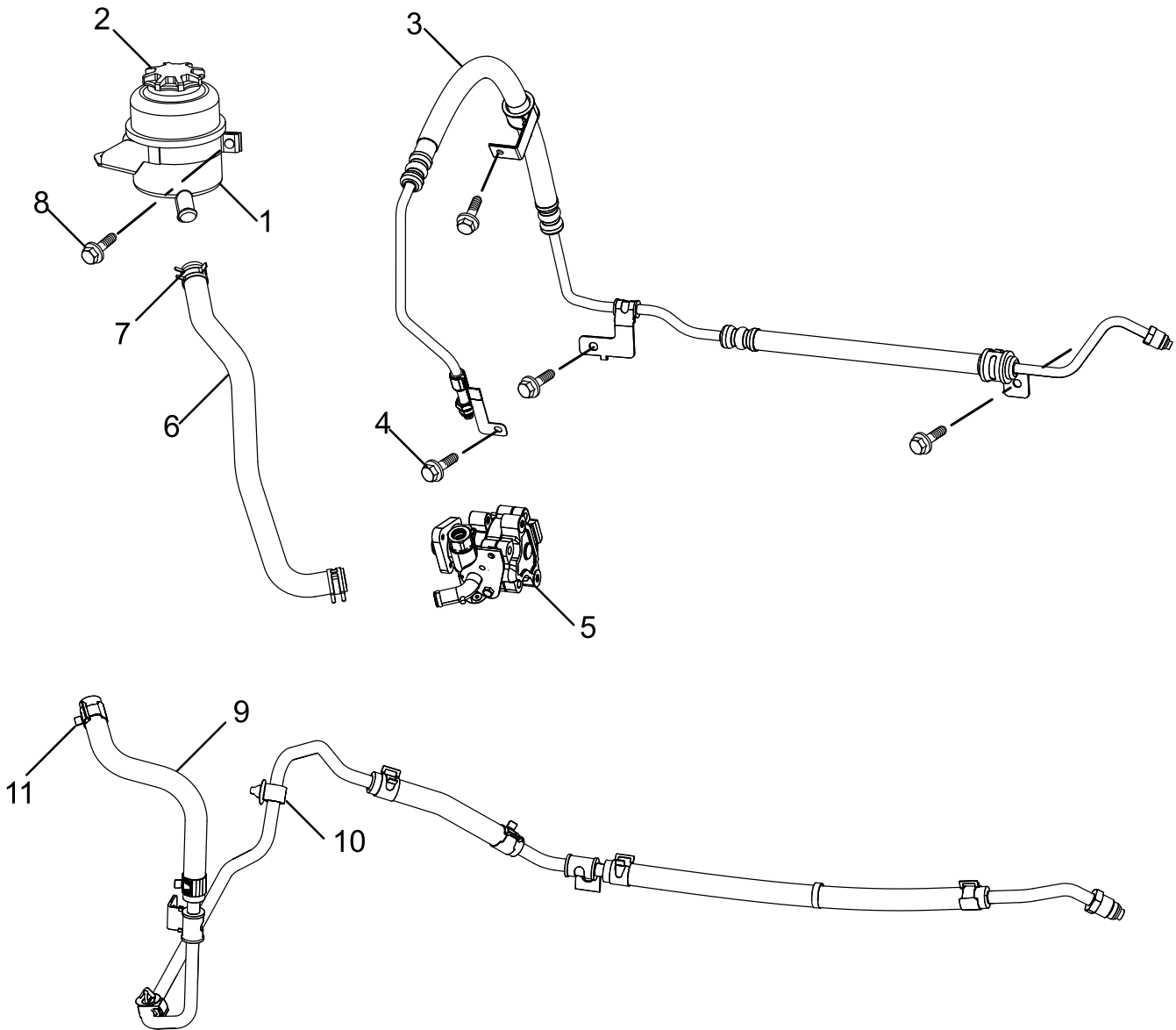
- 4. Bolt - Steering Column to Steering Gear
- 5. Steering Column Upper Trim Panel Assembly
- 6. Steering Column Lower Trim Panel Assembly

Steering Gear Assembly Component Layout



- 1. Steering Gear Assembly
- 2. Steering Mechanism Heat Shield
- 3. Bolt - Steering Mechanism Heat Shield
- 4. Steering Gear Outer Ball Joint
- 5. Bolt - Steering Gear to Sub Frame Bracket
- 6. Cotter Pin - Steering Gear to Steering Knuckle
- 7. Nut - Steering Gear to Steering Knuckle
- 8. Gaiter

Power Assisted Steering Pump Assembly Component Layout



1. Power Steering Reservoir Assembly
2. Power Steering Reservoir Cover
3. Power Assisted Steering Pump to Steering Gear Inlet Tube Assembly
4. Steering Gear Inlet Tube Set Bolt
5. Power Assisted Steering Pump
6. Reservoir to Steering Pump Suction Pipe Assembly
7. Clamp
8. Screw - Power Steering Reservoir Bracket
9. Steering Return Tube Assembly
10. Steering Return Tube Snap Fit
11. Steering Return Tube Clamp

Description

General Description

The steering system mainly consists of a two-piece collapsible steering column, a power steering gear, a power assisted steering pump, a pressure sensor, a power steering oil reservoir, steering oil cooler and steering oil hard tube and hose.

Steering Column

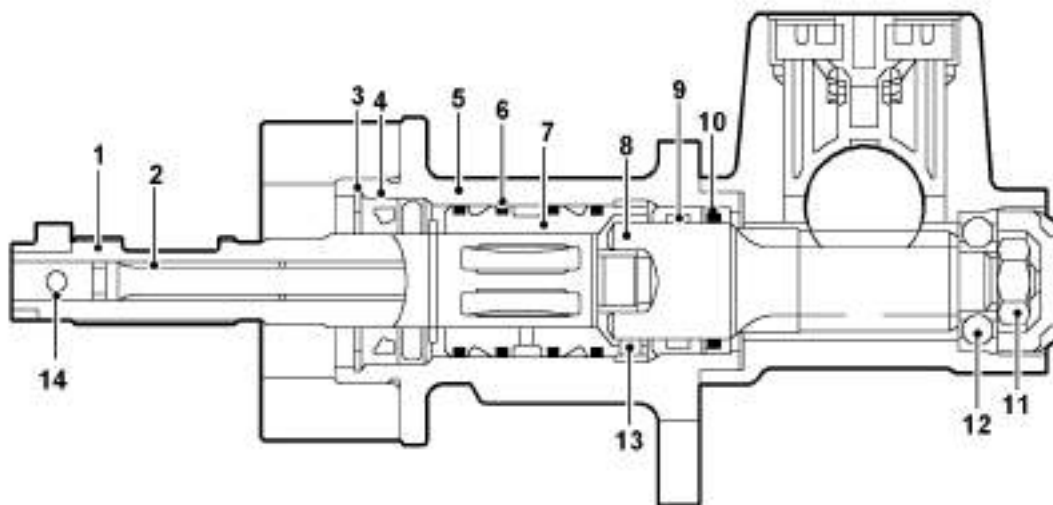
The steering column is an adjustable mechanism, it takes the movement of the engine and steering system compartment position into account when the vehicle is subjected to a strong impact. The steering column is fitted on the instrument panel tube beam, and the upper part of it can slide away from the driver while the lower part can crumple. The steering wheel tilt is adjustable, there are a balance spring and a position-limit gasket at the adjustment end for easy tilt adjustment. There is a double-walled seal retainer between the steering column and the dash panel. The steering wheel is 370 mm in diameter, it consists of a centre hub, a frame cast and the special materials casting on the cast, and the steering wheel centre hub is connected to the steering column with the spline groove. All switches such as the horn switch and the entertainment

control switch are connected to the rotary coupler joint by the connecting wire. An airbag located in the steering wheel centre and under the plastic cover protects the driver's face and upper part of the body.

Power Steering Gear

The power steering gear is fitted in a proper position which is located under the front sub frame rear member. As the mounting point of the power steering gear and the suspension rotation fulcrum are determined by the precisely machined rigid front sub frame, in any time, it can keep the relative design geometric dimension between the steering gear rack mechanism and the suspension. The power steering gear is set by two bolts. Three turns are needed when turning the power steering gear from one side to the other side of the lock position, the total gear ratio of the gear rack is 15.44:1, and the motion range of the steering gear rack is covered by the rubber bellows protector. One end of the steering rod is assembled on the steering gear with threads and secured by the lock nut, and it functions as adjustment of steering system alignment. The other end is secured to the steering arm which extends from the front hub with the lock nuts.

Steering Valve Unit



S382005

- | | |
|--|---|
| <ul style="list-style-type: none"> 1. Input Shaft 2. Torsion Bar 3. Stopper Snap Ring 4. Lubricant Seal Ring 5. Valve Casing 6. Teflon (PTTE) Seal Ring (4) 7. Outer Column Spool | <ul style="list-style-type: none"> 8. Pinion Shaft 9. Bearing 10. Lubricant Seal Ring 11. Nut 12. Bearing 13. Pin - Pinion Shaft and Torsion Bar Connection 14. Pin - Rotor and Torsion Bar Connection |
|--|---|

The steering valve unit and the steering gear are integrated as an unit and its operating principle is: use the least force

needed on the steering wheel to make the best assistant effect (for example: turn when parking).

There are 4 holes on the steering valve unit casting housing, they separately provide the pressure supply of the power steering oil pump, the return of the power steering oil reservoir, the fluid of steering valve unit to the circular surface and the entire pump body. A check valve and a seal ring are fitted in the pressure oil supply hole of the power assisted steering pump.

The steering valve unit consists of an outer column spool, rotor, torsion bar and pinion shaft. The steering valve unit is a double shaft structure with the pinion shaft, and the pinion shaft is connected to the steering column with the input shaft. The steering valve unit is located in a housing, and the housing is connected and secured to the paired casting on the steering gear body with the screws.

The outer column spool is located in the main hole of the steering valve unit, and 3 ring grooves are machined on its outer surface in a machining way. The teflon seal rings located between the ring grooves are used to seal the main hole of the steering valve. The radial holes are drilled along the spool wall in each ring groove. There is a machined hole on the outer column spool to admit the input shaft. The 6 narrow grooves are equally machined in the spool hole, the end of the narrow grooves are sealed and not extended to the end of the spool. The radial holes on the outer spool are drilled until being connected to each narrow groove.

The outer end of the input shaft is machined with splines and a lateral hole used for the torsion bar; the inner end of the input shaft is also machined with the splines which is for gap fit with the corresponding splines on the pinion shaft. The width of the splines allows the torsion bar to turn several degrees before the two splines engaged with each other. The splines connection between the pinion shaft and the input shaft can ensure that the steering system can be operated manually and the torsion bar will not be overloaded when the steering assist is invalid. The vertical narrow grooves laid alternately along the circle of the input shaft are equally machined on the centre circle of the input shaft.

The torsion bar is assembled in the rotor, and connected with the input shaft and pinion shaft through a pin. The diameter of the centre part of the torsion bar is slightly less than the diameters of the both ends after being machined. The smaller diameter allows the torsion bar to twist according to the torque applied on the steering wheel, and this torque is related to the grip of the tyre.

The machined teeth on the centre diameter of the pinion shaft are for gap fit with the teeth on the steering gear. The machined splines located in the hole which is on the upper of the pinion shaft are for gap fit with the similar splines on the rotor. The pinion shaft is located in a casting housing, and the

housing is one part of the steering gear and rotated on a roller bearing of the ball.

Power Assisted Steering Pump

The pressure of the steering system is provided by the impeller type power assisted steering pump which is driven by the crankshaft through the steering pump belt, when the engine is running, the hydraulic oil is sucked from the reservoir by the steering pump, the amount of the supplied oil and the pressure are adjusted by the flow control valve of the steering pump, the remaining oil returns to the inlet of the oil pump through the internal oil path.

Warning: Take extra care when working on the hydraulic pressure system, as the high pressure liquid can be very hot. The pressure will be over 10000 KPa when the pump is operating, personal injury may be caused if not care.

Power Steering Fluid Flow

The hydraulic pressure from the power assisted steering pump is sent to the steering valve through the steering pinion, the control valve controls the hydraulic pressure and changes the direction of fluid flow. The fluid is guided into the pressure cylinder on the corresponding side of the steering gear, and the propelling force of the steering gear rack is formed here. The pressure oil returns from the pressure cylinder of the steering gear through an annular passage of the return tube, and the annular passage functions as cooling the power steering oil before the power fluid returns to the steering oil reservoir. The steering oil reservoir is a place for storing the power steering fluid.

Power Steering Oil Reservoir

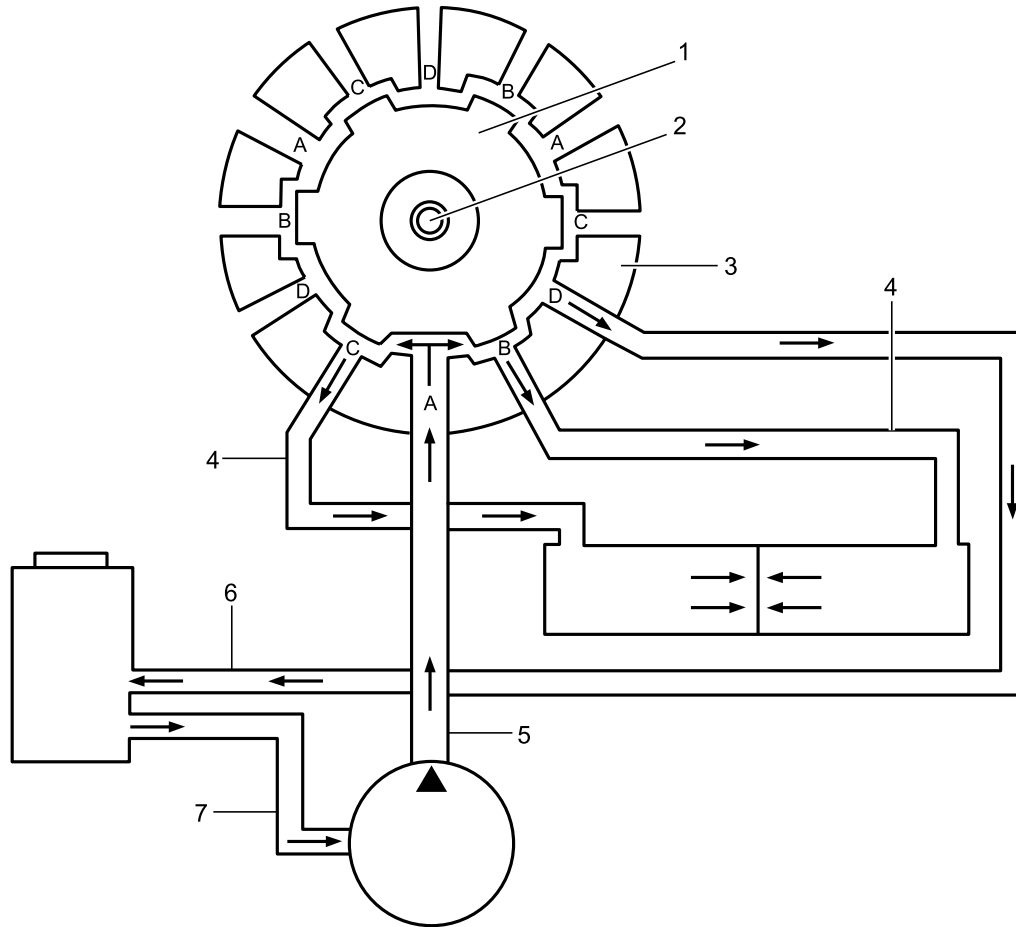
The power steering oil reservoir consists of reservoir body, reservoir cap and filter assembly. There is a steering oil reservoir level dipstick integrated with the reservoir cap and an "O" seal ring fitted on the reservoir cap which helps to prevent from leakage on the reservoir cap. There is an air vent on the reservoir cap which allows the height of the steering oil reservoir level to change during the operating. The filter assembly is fitted at the bottom of the steering oil reservoir. The filter is made of the subtle stainless steel wire mesh which is molded in the filter bracket. The grain matters in the steering oil reservoir can be filtered out by the filter before the steering oil enters the oil supply line. The filter is a maintenance-free component. The basic function of the steering oil reservoir is to keep a certain amount of the remaining steering oil so as to allow the steering oil to expand and shrink under different temperatures. The height of the steering oil level can ensure that the oil supply pipe is covered with oil all the time in all operating conditions. Any air in the hydraulic system will be ejected from the fluid in the steering oil reservoir.

The turning of the steering wheel is transmitted to the steering valve which is fitted on the steering gear rack mechanism via the steering column. The rotation of the turn is converted to the rectilinear motion of the steering rack via the gear and

rack. The high pressure flow on the steering gear provides the steering assist when the engine is running and the power assisted steering pump is operating.

Operation

Neutral Position

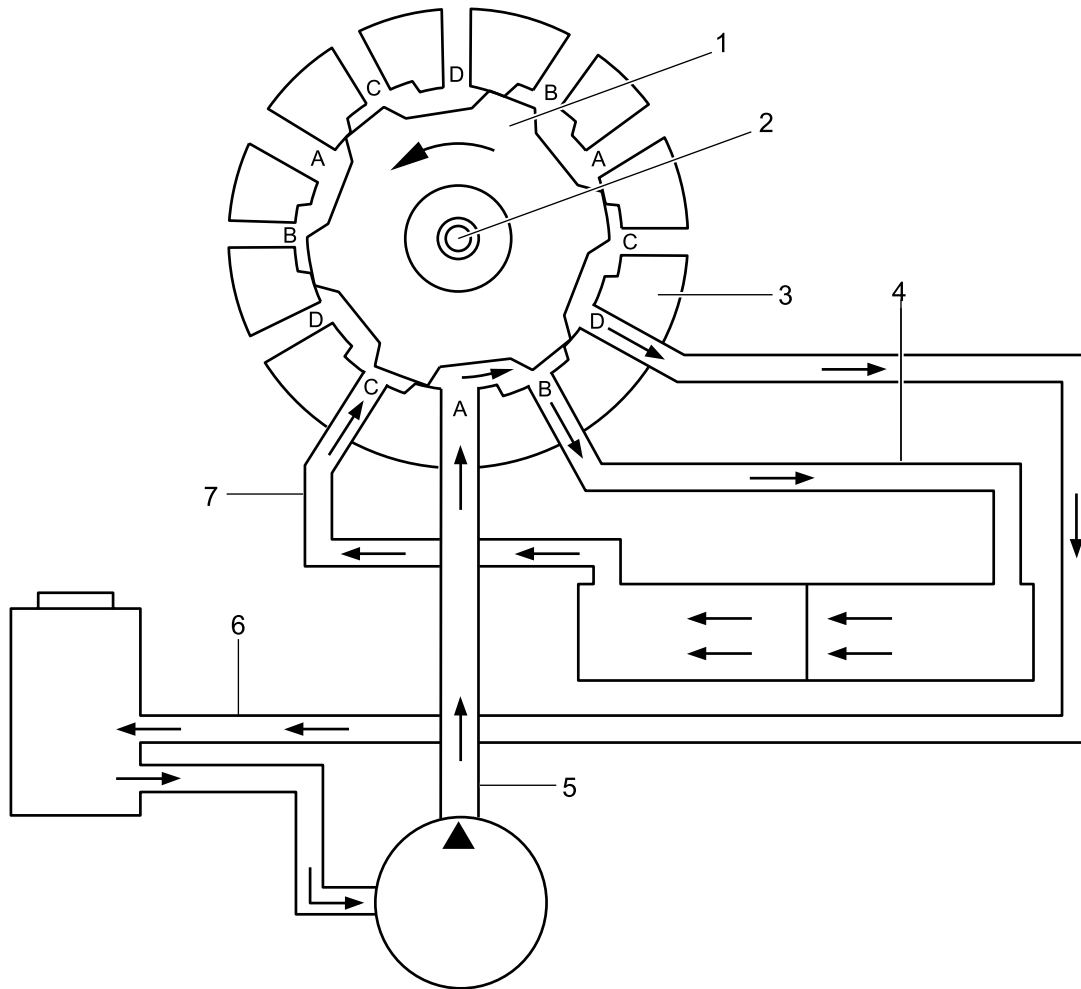


- 1. Rotor
- 2. Torsion Bar
- 3. Spool
- 4. Pressure Oil Flow of Steering Gear Cylinder
- 5. Pressure Oil of Power Assisted Steering Pump
- 6. Return of Reservoir Tank
- 7. Supply of Reservoir Tank

The power steering fluid flows from the power assisted steering pump to the steering valve when driving the vehicle with the steering wheel facing straight ahead. Align the narrow groove on the outer column spool with the narrow groove on the rotor, this will cause the fluid pressure over the steering valve. Partial pressure is applied to the inlet side and return

side of the steering gear cylinder, this partial pressure is sensed by the pistons on both sides of the steering gear cylinder. The steering is kept in centre position because the pressure on both sides of the steering gear cylinder is equal. Because a majority of fluid has flowed into the steering oil reservoir, the pressure on each side of the piston is very low.

Turn Left

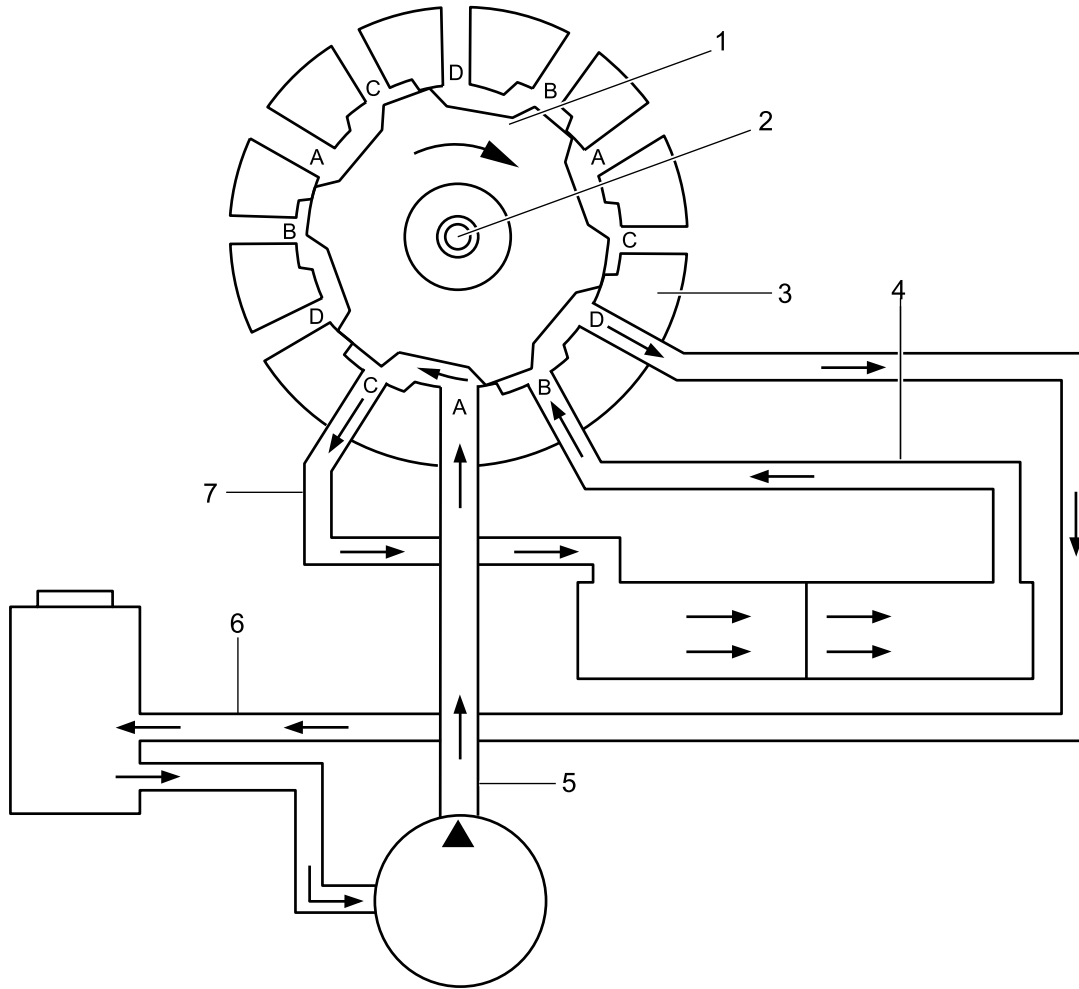


- 1. Rotor
- 2. Torsion Bar
- 3. Spool
- 4. Pressure Oil Flow of Steering Gear Cylinder LH
- 5. Pressure Oil of Power Assisted Steering Pump
- 6. Return of Reservoir Tank
- 7. Oil Flow of Steering Gear Cylinder RH

When turning the steering wheel counterclockwise, the rotor and the torsion bar rotate in the same direction. The position of the narrow groove on the rotor has been changed and not in the centre alignment position, and the narrow groove blocks the fluid from returning to the steering oil reservoir. After this time, the hydraulic pressure flows from the power assisted steering pump into the realigning narrow grooves on the rotor and the outer column spool, the hydraulic pressure is guided into the left side of the steering gear cylinder via the aligning

narrow groove so as to increase the pressure of the cylinder on the left side of the steering gear. The reflux inlet of the cylinder on the right side of the steering gear is open, this allows the fluid to flow from the cylinder piston on the right side of the steering gear into the power steering oil reservoir. The pressure difference of the cylinder pistons on the left side and the right side of the steering gear generates the steering assist.

Turn Right



- 1. Rotor
- 2. Torsion Bar
- 3. Spool
- 4. Oil Flow of Steering Gear Cylinder LH
- 5. Pressure Oil of Power Assisted Steering Pump
- 6. Return of Reservoir Tank
- 7. Pressure Oil Flow of Steering Gear Cylinder RH

When turning the steering wheel clockwise, the rotor and the torsion bar rotate in the same direction. The position of the narrow groove on the rotor has been changed and not in the centre alignment position, and the narrow groove blocks the fluid from returning to the steering oil reservoir. After this time, the hydraulic pressure flows from the power assisted steering pump into the narrow grooves realigned on the rotor and the outer column spool, the hydraulic pressure is guided into the right side of the steering gear cylinder via the aligning narrow groove so as to increase the pressure of the cylinder on the right side of the steering gear. The reflux inlet on the left side of the cylinder is open, this allows the fluid to flow from the piston on the left side of the steering gear into the steering oil reservoir. The pressure difference on the left side and the right side of the steering gear cylinder piston generates the steering assist.

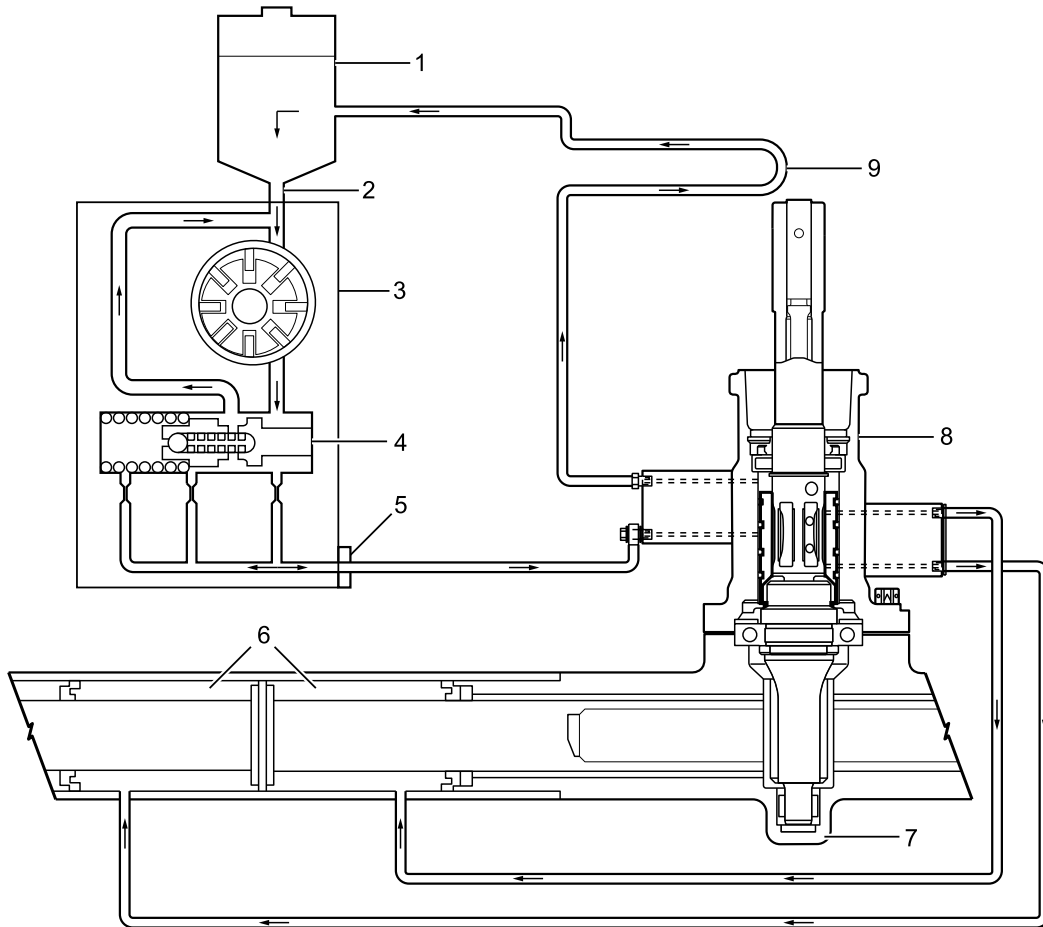
Accumulation Assist

The accumulation assist steering depends on the amount of the wheel road resistance which has an opposite direction

with the front wheels rotation direction. When turning the steering wheel to left or right, the rotary motion is transmitted to the rotor shaft via the steering column, allowing the rotor shaft and the steering wheel to turn with the same rotation amount. The rotary motion is transmitted to the torsion bar simultaneously. If the wheel resistance is very high (such as the parking condition), the torsion bar will be twisted. The torsion of the torsion bar means that the rotation amount of the pinion and the spool is slightly less than the rotor. The narrow grooves on the rotor and the torsion bar detach from the alignment position due to the torsion of the torsion bar, and cause the gap between the two narrow grooves to increase. The bigger the road resistance of the steering rotary motion from the wheels, the bigger the deflection amount between the narrow grooves of the rotor and the torsion bar, the hydraulic pressure passed through the appropriate side of the steering gear cylinder increases with the rotation amount increasing. When the road resistance of the wheels or the steering force applied to the steering wheel decreases, the torque applied to

the rotor decreases, the torsion bar is loosened, causing the rotation amount between the narrow grooves of the rotor and the torsion bar to decrease, so as to decrease the hydraulic pressure applied to the appropriate side of the steering gear cylinder.

Hydraulic Circuit



- | | |
|---------------------------------------|---|
| 1. Steering Oil Reservoir | 6. Steering Gear Cylinder Pressure Area |
| 2. Low Pressure Inlet Tube | 7. Steering Gear Rack Mechanism |
| 3. Power Assisted Steering (PAS) Pump | 8. Steering Valve Unit |
| 4. Outlet | 9. Power Steering Oil Cooler Tube |
| 5. Flow Control/Safety Valve | |

After starting the engine, the power assisted steering pump sucks the power steering fluid of the steering oil reservoir into the low pressure inlet tube, the power steering fluid changes into the high pressure fluid at the outlet after flowing over the power assisted steering pump, the high pressure fluid reaches the steering valve through a high pressure oil tube. If the steering force has not been applied, the pressures on both sides of the steering gear cylinder piston are equal, the remaining fluid returns to the steering oil reservoir from the steering valve through the power steering oil cooler tube. If

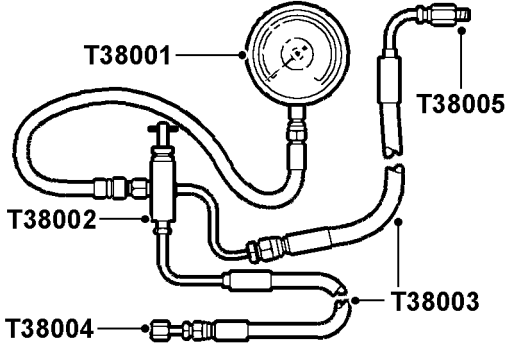
the steering force used for turning to the any side has been applied, the oil pressure is guided into the appropriate side of the steering gear cylinder piston, the pressure provides the steering assist and reduces the required steering force. The discharged power steering fluid due to the movement of the piston in the steering gear cylinder flows from the steering valve and returns to the steering oil reservoir through the power steering oil cooler tube. The power steering oil cooler tube can decrease the temperature of the power steering fluid and extend the life of the hoses and the seals of the system.

Service Procedures

Power Assisted Steering System - Pressure Test

Inspection

1. Test Device



S383003

- a. Fit the pressure gauge T38001 and hose to the valve assembly T38002 and tighten the union.
 - b. Fit the 2 hoses T38003 to the valve assembly T38002 and tighten the union.
2. Disconnect the battery negative terminal.

Caution: Care must be taken to ensure that the oil or other fluid does not enter or contaminate the alternator.

3. Put a container to collect fluid which spills out from the **PAS** system.
4. Clean the power assisted steering pump, connector tube and tube joint.
5. Remove the butt bolt securing the steering gear inlet tube to the power assisted steering pump.
6. Fit the union T38005 and seal washer to the power assisted steering pump.
7. Fit the union T38004 to the power steering gear apply pipe with the butt bolt and seal washer.
8. Connect the hose T38003 to the T38004 and T38005.
9. Make sure all tubes and mountings **DO NOT** contact with rotation components.
10. Hang the pressure gauge to a safe place under the bonnet.
11. Connect the battery negative terminal.
12. Start the engine and bleed the power assisted steering system.

Power Assisted Steering (PAS) System Bleeding

13. Check the power assisted steering pump fluid level and fill it fully.
14. Test procedures:

- a. Make sure there are no leaks from the steering system and the fluid level is maximum when performing the test.
- b. Start the engine when the test device valve is open.
- c. When the engine is idling and in a normal operating temperature, turn the steering wheel slowly and hold it to the lock position.
- d. Repeat this pressure test in the opposite lock position.
- e. The test pressure should increase from 5 bar to 90 bar slowly, the pressure may increase to 90 bar according to road condition when steering is in the full lock position.
- f. When the engine is idling, release the steering wheel, the pressure reading should be 5 bar or less.
- g. There may be a malfunction if the pressure is out of the value above.

Adjustment

1. To determine if the steering pump or steering gear is defective, close the test valve for a maximum of 5 seconds. If the test valve is closed for an extended period of time, the pump will be damaged.
2. If the reading of pressure gauge is not between 85-95 bar (the maximum pump pressure), the pump is defective.
3. If the maximum pressure of the pump is correct, the steering gear may be defective.
4. Stop the engine after the test has been completed.
5. Loosen the battery negative terminal.
6. Remove the power steering oil reservoir and put it aside.
7. Remove the test device union.
8. Remove the union from the power assisted steering pump and power steering gear inlet tube.
9. Fit a new seal washer and fit the apply pipe to the power assisted steering pump, tighten the butt bolt to **35-40 Nm**.
10. Clean the chassis and surrounding area.
11. Fit the power steering oil reservoir.
12. Check the power assisted steering system fluid level.

Capacity Fluid

13. Connect the battery negative terminal.

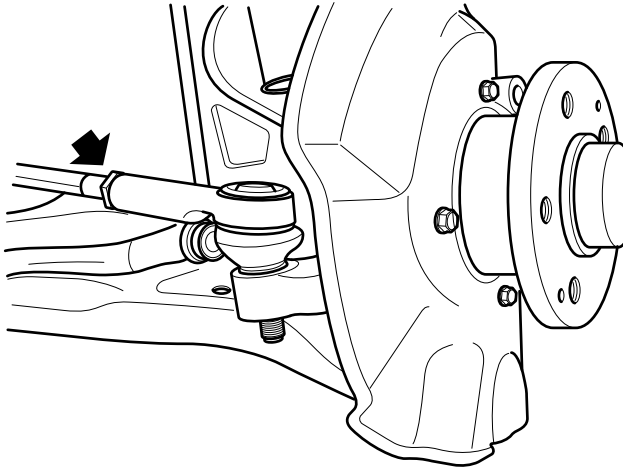
Steering Rod

Removal

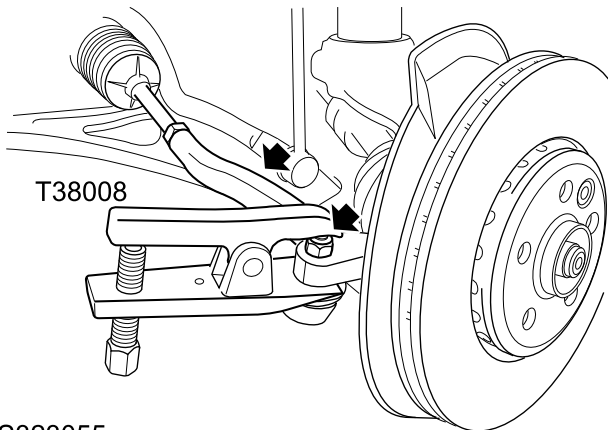
1. Raise the vehicle on a lift.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

2. Remove the front wheels.
3. Loosen the lock nut on the steering rod.



4. Remove the nut from the steering rod ball joint and dispose it.
5. Fit a M10 nut to the steering rod ball joint so that it is flush with the pin end.
6. Disengage the ball joint from the steering arm using the tool T38008. Remove the M10 nut from the ball joint.



S323055

7. Unscrew the steering rod outside ball joint from the power steering gear, mark the position of the lock nut.

Refit

1. Screw the steering rod to the mark position of the lock nut and with the ball joint facing downward.
2. Connect the steering rod ball joint to the steering arm, fit a new nut and tighten it to **35-40 Nm**.
3. Fit the wheel and tighten the bolt to **115-130 Nm**.
4. Lower the vehicle.
5. Check the wheel alignment parameter for the front

wheels.



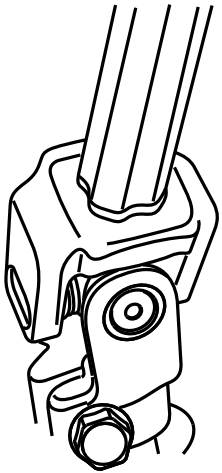
Power Steering Gear Assembly

Removal

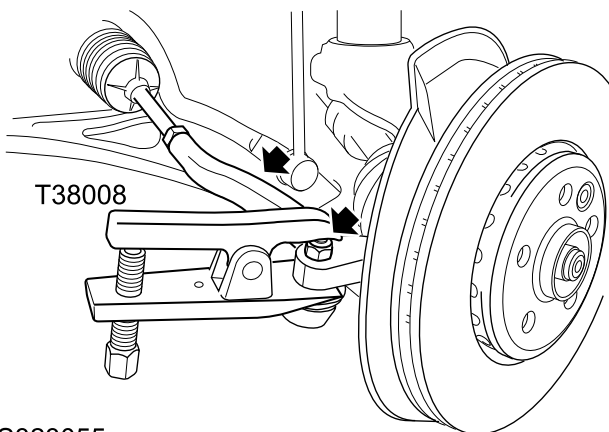
1. Raise the vehicle on a lift.
2. Move the floor carpet and slide the steering column seal down in order to expose the bolt securing the joint to the power steering gear.

Caution: Before disconnecting any parts of the steering linkage, ensure the wheels are positioned straight ahead and the steering wheel is prevented from turning. Unrestricted turning of the steering wheel will damage the SRS rotary coupler.

3. Remove the bolt securing the joint to the power steering gear and dispose it.



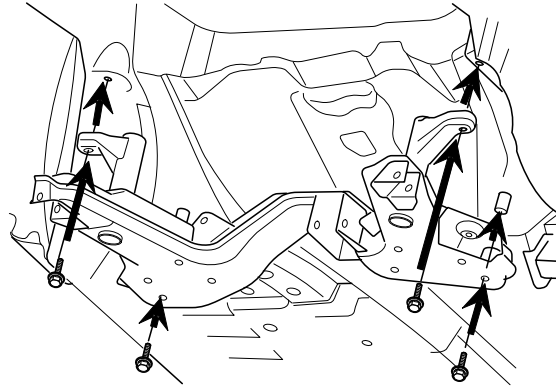
4. Loosen the joint from the power steering gear.
5. Remove the front wheels.
6. Remove the nut securing the steering rod to the steering arm. Fit a M10 nut to the ball pin so that it is flush with the pin end.
7. Loosen the steering rod ball joint from the steering arm using the tool T38008. Remove the M10 nut from the ball pin.



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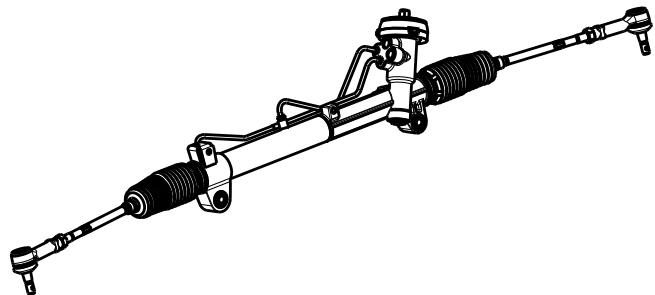
8. Remove the nut securing the anti roll bar link to the anti roll bar and loosen the anti roll bar link.
9. Put the anti roll bar aside.

10. Support the rear of the sub frame with hydraulic pressure lifting equipment.
11. Loosen the 2 mounting bolts securing the rear of the front sub frame support plate.
12. Loosen the 2 bolts securing the front sub frame to the rear of the white body.

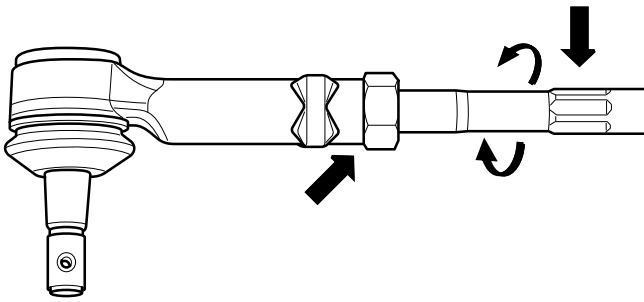


S323020

13. Support rear of the sub frame with hydraulic pressure lifting equipment.
14. Remove the 2 centre bolts and rear bolt which set the sub frame and the sub frame strut bar to the vehicle body and dispose them, collect the washer.
15. Lower the rear of the sub frame.
16. Put a container to collect the spilled fluid.
17. Remove the tube union which sets the power steering gear return tube to the power steering gear, and dispose the O-ring.
18. Remove the tube union which sets the power steering gear inlet tube to the power steering gear, and dispose the O-ring.
19. Remove the 2 bolts securing the power steering gear to the sub frame.



20. Pull out the power steering gear from the driver side.
21. Remove the power steering gear input shaft seal ring.
22. Mark the positions of each steering rod end lock nut and take them as a reference of fitting.



23. Remove the steering rod end and lock nut from the power steering gear.

Refit

1. According to the thread mark noted during the removal, centre the power steering gear and set each lock nut to the steering rod.
2. Set the steering rod ball joint to the lock nut of the steering gear, make the steering rod ball joint face up.
3. Fit the power steering gear input shaft seal to insure that the dent on the seal is located at the raised "mark" on the gear.
4. Position the power steering gear onto the sub frame, be careful not to drop the steering gear input shaft seal.
5. Fit the 2 upper bolts and tighten them to **100-130 Nm**.
6. Clean the tube union and the mating surface.
7. Fit a new O-ring to the steering gear return tube, connect the tube and tighten the tube union to **20-26 Nm**.
8. Fit a new seal washer to the steering gear inlet tube, connect the tube and tighten the tube union to **20-26 Nm**.
9. Lift the sub frame, then fit the washer, sub frame strut bar and the new bolt securing the sub frame, and tighten the bolt to **105-126 Nm**.
10. Fit the bolt securing the sub frame strut bar to the body and tighten the bolt to **64-77 Nm**.
11. Move the hydraulic pressure lifting equipment away.
12. Fit the anti roll bar link to anti roll bar, then fit the nut and tighten it to **40-60 Nm**.
13. Connect the steering rod to the steering arm, fit new nut and tighten it to **35-45 Nm**.
14. Fit the wheel and tighten the bolt to **115-130 Nm**.
15. Fit a new bolt securing the joint to the power steering gear input shaft, then tighten the bolt to **18-25 Nm**.
16. Secure the joint seal. Put the floor carpet to the original place.
17. Bleed the power assisted steering system.

Power Assisted Steering (PAS) System Bleeding

18. Check the four-wheel alignment parameter.

Four-wheel Alignment

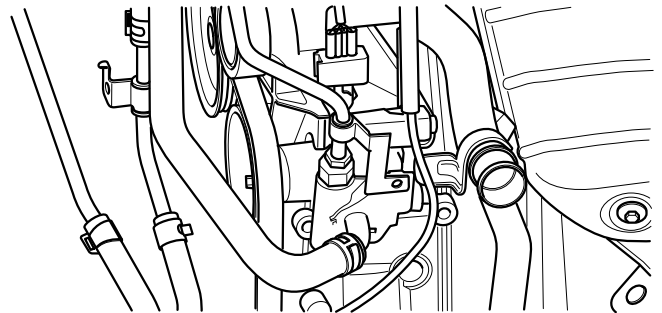
Power Assisted Steering Pump

Removal

1. Disconnect the battery earth lead.
2. Lift the front of the vehicle.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

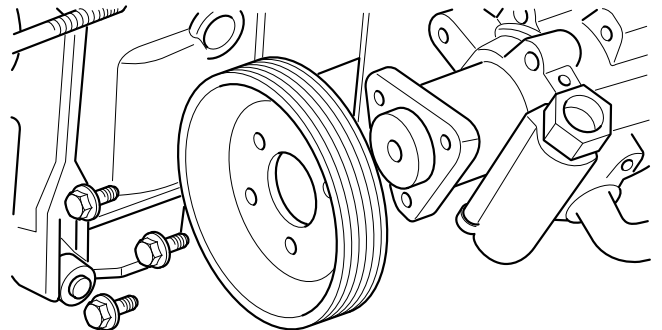
3. Put a container to collect the spilled fluid.
4. Remove the inlet joint and outlet joint of the power assisted steering pump.



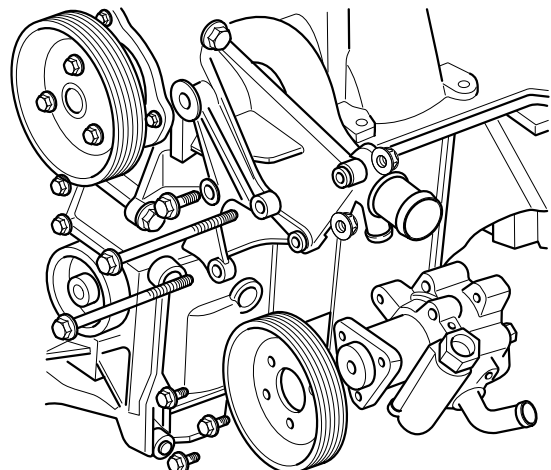
5. Remove the auxiliary drive belt.

Auxiliary Drive Belt

6. Remove the 3 service bolts securing the power assisted steering pump pulley to the power assisted steering pump.



7. Remove the 3 service bolts connecting the power assisted steering pump to the bracket.

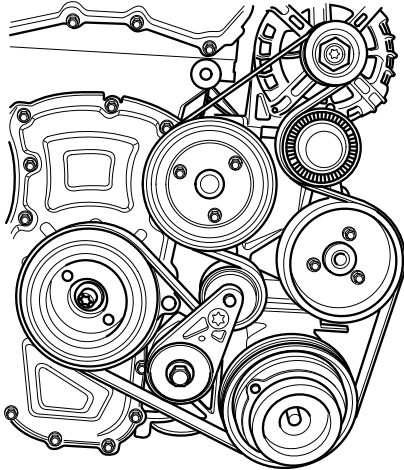


8. Remove the power assisted steering pump.

Refit

1. Clean the power assisted steering pump and the mating surface.
2. Fit the 3 service bolts connecting the power assisted steering pump to the bracket.
3. Fit the power assisted steering pump pulley to the power assisted steering pump with the 3 service bolts.
4. Fit the auxiliary drive belt.

Auxiliary Drive Belt



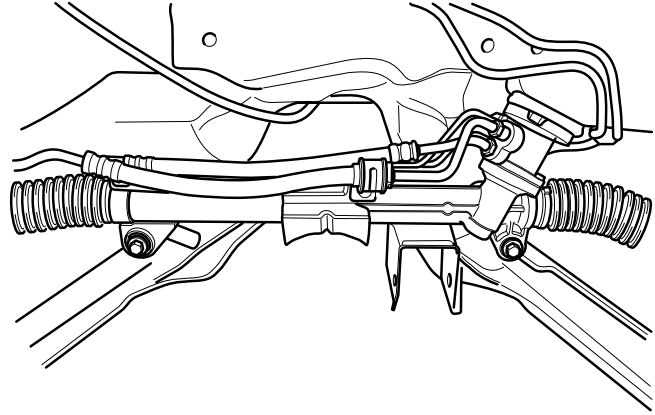
5. Clean and fit the inlet joint and outlet joint of the power assisted steering pump.
6. Lower the vehicle.
7. Connect the battery earth lead.
8. Bleed the power assisted steering system.

Power Assisted Steering (PAS) System Bleeding

Power Steering Inlet Tube

Removal

1. Disconnect the battery earth lead.
2. Lift the vehicle.
3. Put a container to collect the spilled fluid.
4. Remove the power steering gear inlet tube union, then remove the seal washer and dispose it.



Caution: To prevent damage to components, use two wrenches simultaneously when loosening or tightening the tube unions.

Caution: Plug the disconnected unions to prevent contamination entering.

5. Remove the tube union securing the power steering gear inlet tube to the steering pump, remove the seal washer and dispose it.

Caution: To prevent damage to components, place a wood board or hard rubber at the bottom of the jack.

Caution: Plug the disconnected unions to prevent contamination entering.

6. Remove the power steering gear inlet tube assembly from the engine bay.

Refit

1. Clean the power steering gear inlet tube end and mating surface.
2. Position the inlet tube into the engine bay.
3. Fit the power steering inlet tube to the pump with the new seal washer, fit the tube union and tighten it to **35-40 Nm**.

Caution: To prevent damage to components, place a wood board or hard rubber at the bottom of the jack.

4. Fit the power steering gear inlet tube to the power steering gear with the new seal washer, fit the tube union and tighten it to **20-26 Nm**.

Caution: To prevent damage to components, place a wood board or hard rubber at the bottom of the jack.

5. Move the container away.

6. Connect the pressure sensor connector.
7. Connect the battery earth lead.
8. Bleed the power assisted steering system.

Power Assisted Steering (PAS) System Bleeding

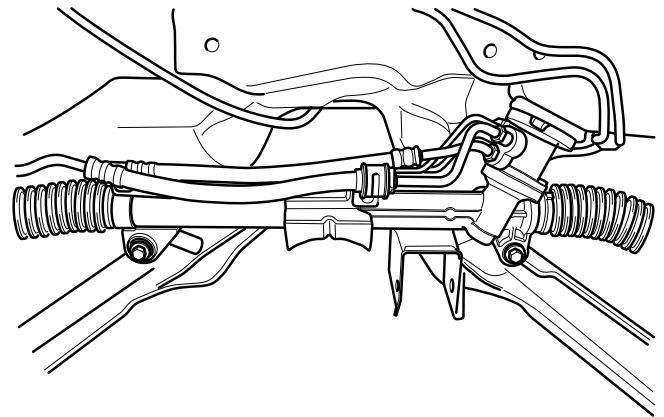
Steering Return Tube Assembly

Removal

1. Remove the front bumper.

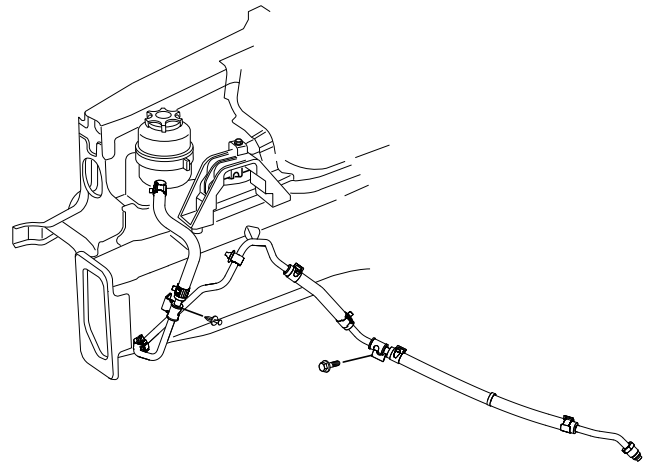
Front Bumper Assembly

2. Lift the vehicle
3. Put a container to collect the spilled fluid.
4. Loosen the clamp of the return tube assembly and PAS pump.
5. Remove the tube union securing the steering gear return tube to the power steering gear, remove the washer and dispose it.



Caution: Plug the disconnected unions to prevent contamination entering.

6. Remove the 2 bolts securing the return tube assembly to the body, and then remove the return tube assembly.



7. Take out the power steering gear return tube.

Refit

1. Clean the steering gear return tube end and mating surface.
2. Position the steering gear return tube into the engine bay.
3. Remove the plug from the power steering gear.
4. Position the steering gear return tube onto the power steering gear and fit a new washer and tighten the tube union to **20-26 Nm**.

Caution: To prevent damage to components, use two wrenches simultaneously when loosening or tightening the tube unions.

5. Fit the set bolt and tighten it to **19-25 Nm**. Remove the plug and connect the steering gear return tube to the **PAS** pump.
6. Move the container away.
7. Fit the front bumper assembly.

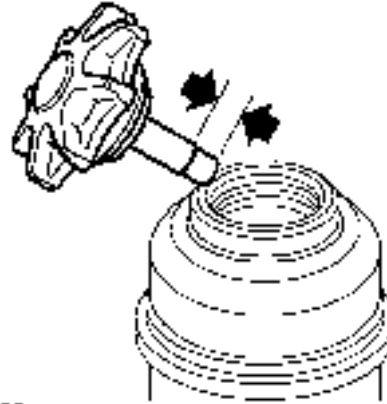
Front Bumper Assembly

8. Connect the battery earth lead.
9. Bleed the power assisted steering system.

Power Assisted Steering (PAS) System Bleeding

Power Assisted Steering (PAS) System Bleeding Adjustment

1. Clean the power steering oil reservoir filler surrounding and the fluid level indicator.



S383000

2. Unscrew the reservoir cover from the power steering oil reservoir, and fill the steering fluid until the level is between the minimum and maximum lines.

Capacity

Fluid

Lubricant

Caution: Care must be taken to ensure that the oil or other fluid does not enter or contaminate the alternator.

3. Start and idle the engine for 10 seconds, and then stop it.
4. Fill the power steering oil reservoir.
5. Start the engine and fully turn the steering wheel from lock to lock, and then stop the engine.
6. Refill the power steering oil reservoir.
7. Start and run the engine for 2 minutes and fully turn the steering wheel from lock to lock.

Caution: **DO NOT** hold the steering gear at full lock point for longer than 10 seconds.

8. Stop the engine.
9. Check the steering oil reservoir, and if the bubbles come out, wait until the bubbles disappear, and then refill the steering fluid to a level between the minimum and maximum lines.
10. Fit the power steering oil reservoir filler cap.

Steering Wheel and Column**Specifications****Torque**

| Description | Value |
|---|------------|
| Bolt - Steering Wheel to Steering Column | 40-60 Nm |
| Bolt - Steering Column to Steering Gear Input Shaft | 18-25 Nm |
| Bolt - Steering Column to Instrument Panel Frame | 20-25 Nm |
| Screw - Steering Column Trim Panel | 1.3-1.9 Nm |

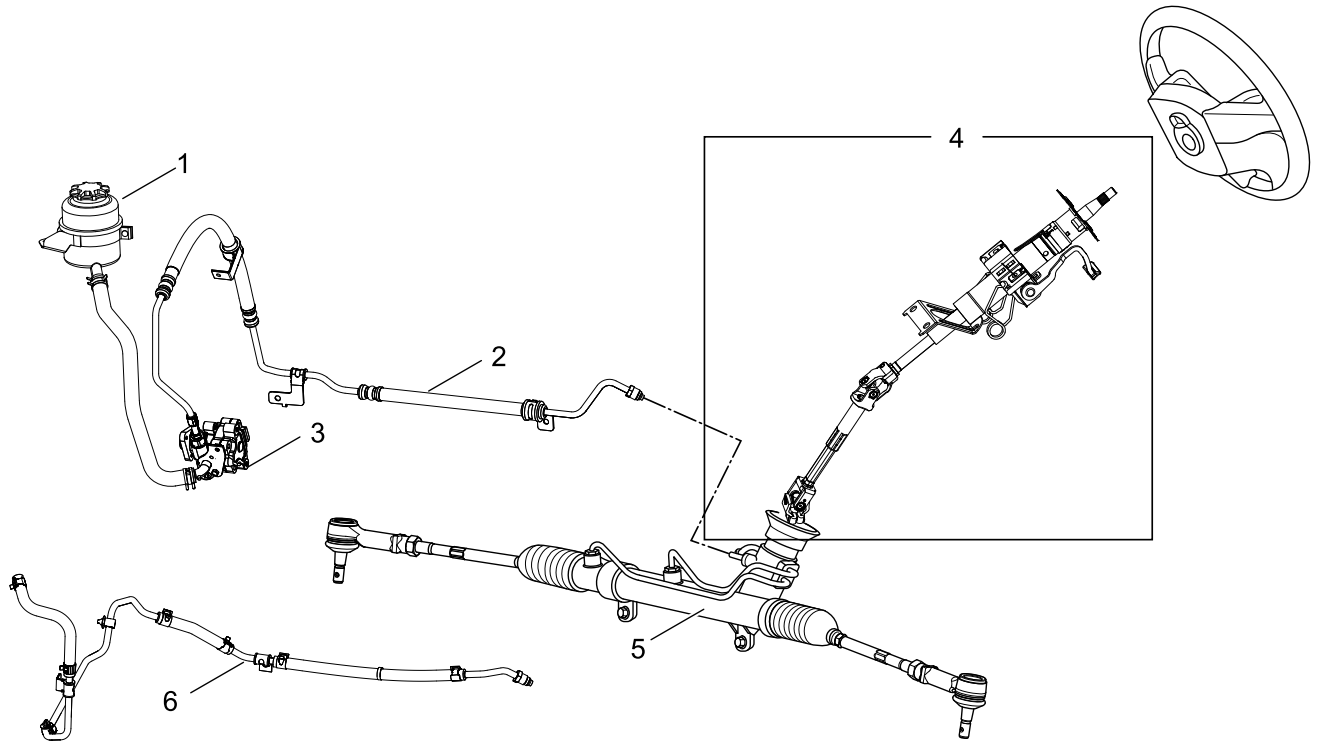
Parameter

| | |
|--|--|
| Type | Hydraulic servo assisted steering gear which can reach the linear gear ratio steering system |
| Steering Column Type | Folding and energy absorbing type, the steering wheel can tilt up and down |
| Steering Wheel Diameter | 370 mm |
| Turns of Steering Wheel - Lock to Lock | 3 |
| Steering Circumference: | |
| Min. Turning Radius | 11.3 m |
| Total Gear Ratio | 15.44: 1 |
| Power Assisted Steering | |
| Operation Pressure | 90 bar |
| Flow | 6-7.5 liters per minute |
| Standard Value | 7.5 L |

Description and Operation

System Component Layout

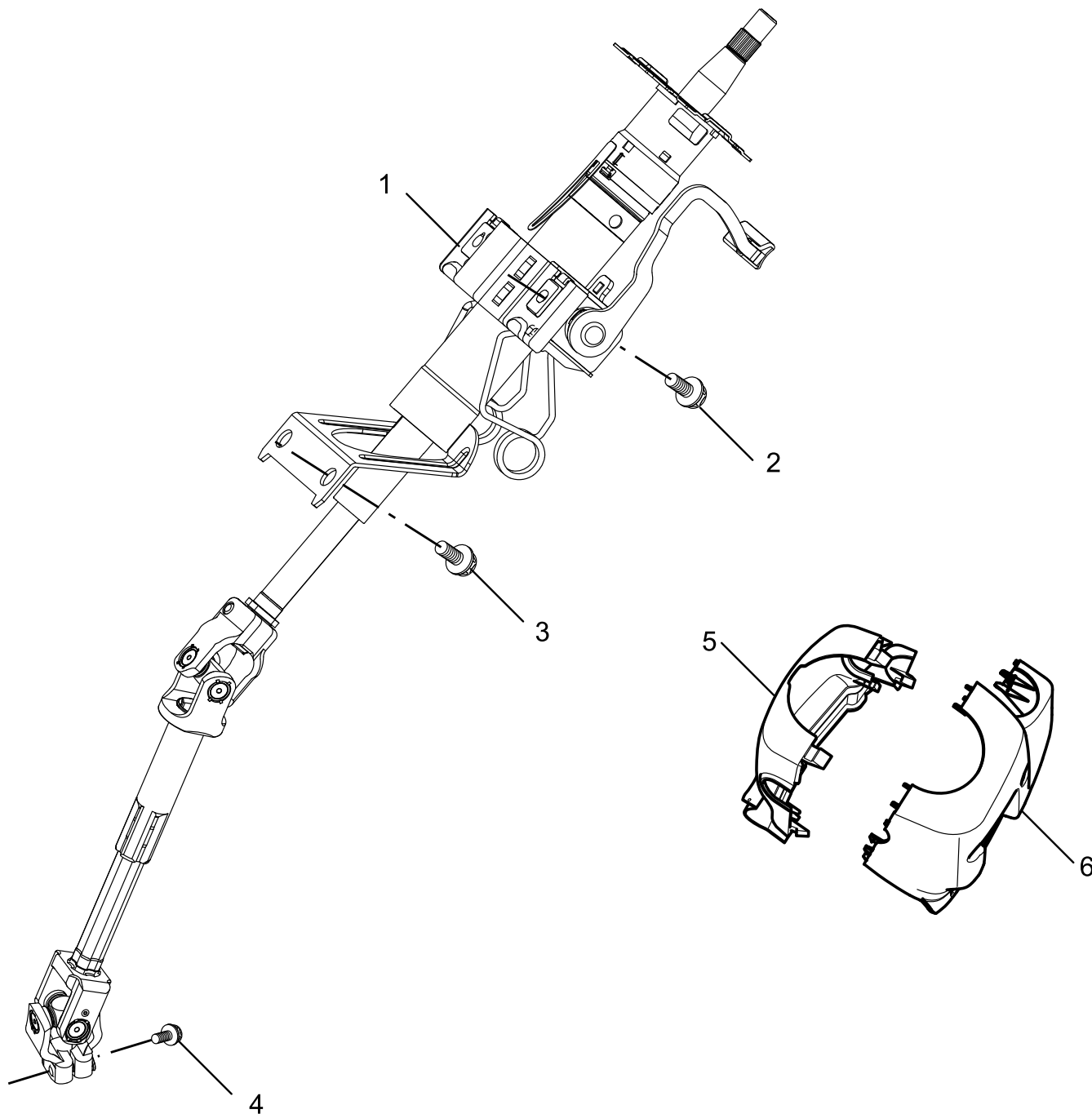
Steering System Component Layout



S382011

- | | |
|--|---------------------------------|
| 1. Power Steering Oil Reservoir Assembly | 4. Steering Column Assembly |
| 2. Steering Gear Inlet Tube | 5. Power Steering Gear Assembly |
| 3. Power Assisted Steering Pump | 6. Steering Gear Return Tube |

Steering Column Component Layout



- 1. Steering Column Assembly
- 2. Bolt (2)
- 3. Bolt (2)

- 4. Bolt - Steering Column to Steering Gear
- 5. Steering Column Upper Garnish Assembly
- 6. Steering Column Lower Garnish Assembly

Description

General Description

The steering system mainly consists of a two-piece collapsible steering column, a power steering gear, a power assisted steering pump, a pressure sensor, a power steering oil reservoir, steering oil cooler and steering oil hard tube and hose.

Steering Column

The steering column is an adjustable mechanism, it takes the movement of the engine and steering system compartment position into account when the vehicle is subjected to a strong impact. The steering column is fitted on the instrument panel tube beam, and the upper part of it can slide away from the

driver while the lower part can crumple. The height and tilt of the steering wheel are adjustable in each direction, and there is a balance spring and a position-limit gasket at the adjustment end for easy tilt adjustment. There is a double-walled seal retainer between the steering column and the dash panel. The steering wheel is 370 mm in diameter, it consists of a centre hub, a frame cast and the special materials casting on the cast, and the steering wheel centre hub is connected to the steering column with the spline groove. All switches such as the horn switch and the entertainment control switch are connected to the rotary coupler union through the connecting wire. An airbag located in the steering wheel centre and under the plastic cover protects the driver's face and upper part of the body.

Service Procedures

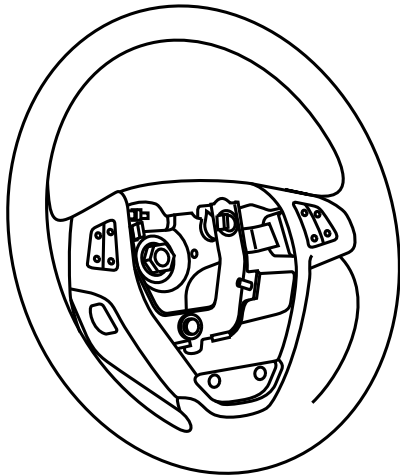
Steering Wheel Assembly

Removal

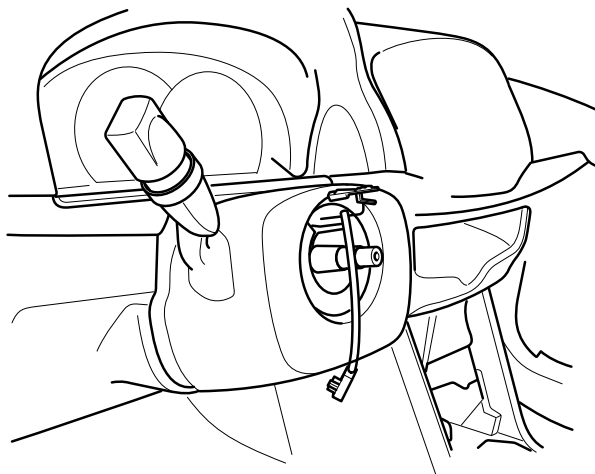
1. Remove the driver side airbag module.

Driver Side Airbag Module

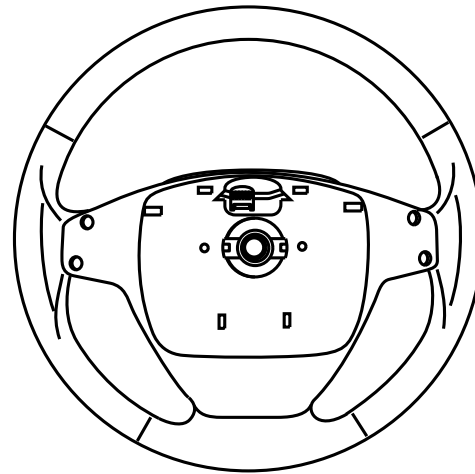
2. Disconnect the wire connector of the steering switch.
3. Centre the steering wheel and place the wheels facing straight ahead.
4. Keep the steering wheel in the position and loosen the nut securing the steering wheel to the steering column until the steering wheel is loosened fully from the spline of the steering column, and then remove the nut.
5. Loosen the steering wheel assembly from the steering column.
6. Remove the corrugated washer nut and the steering wheel assembly.



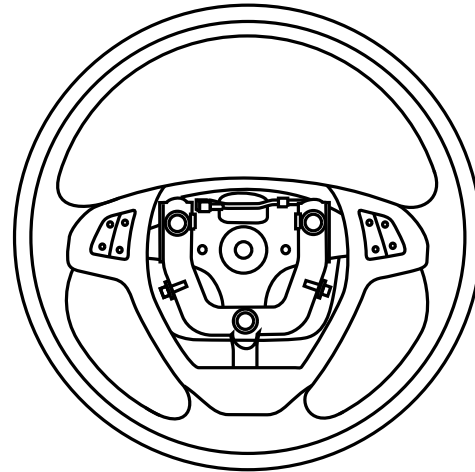
7. Put tape around the steering column lever combination switch edges to keep the correct mounting position.



8. Remove the 2 screws securing the steering switch pad to the front of the steering wheel.



9. Remove the 4 screws securing the steering switch pad to the rear of the steering wheel, move the pad and remove the steering switch.



10. Disconnect the steering switch connector on the steering switch wire and loosen the wire.
11. Disconnect the connection of the earth lead.
12. Remove the wire of the steering wheel carefully.

Refit

1. Fit the earth lead to the steering wheel.
2. Fit the steering switch to the steering switch pad.
3. Fit the 2 screws securing the steering switch pad to the front of the steering wheel.
4. Fit the 4 screws securing the steering switch pad to the rear of the steering wheel.
5. Position the steering wheel wire and secure it to the steering wheel.
6. Connect the steering switch connector and secure it to the steering wheel wire.
7. Remove the tape on the steering column lever combination switch.
8. Make sure the wheels are positioned straight ahead, and fit the steering wheel to the steering column.
9. Fit and tighten the corrugated washer and nut securing the steering wheel to the steering column, then tighten

them to **40-60 Nm**.

10. Connect the steering switch connector.
11. Fit the driver side airbag module.

Driver Side Airbag Module

Steering Wheel Alignment Adjustment

The steering wheel alignment adjustment should be completed by the steering rod, not by removing and fitting the steering wheel.

Inspection

1. Make sure that the tyre pressure is correct and the vehicle is in curb weight condition.
2. Wiggle the vehicle forward and backward to release the force of the steering and hanging.
3. Please use the four-wheel aligner that specified by our company to measure the front wheel alignment parameter.
4. Take the average of 3 readings.
5. Check if the front wheel alignment parameter is within the specified tolerance range.

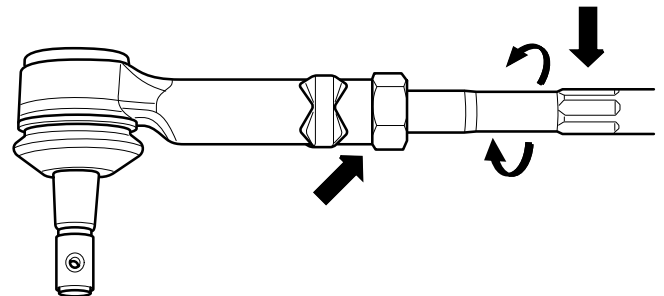
Adjustment

1. Mark the position of the steering rod as a reference.
2. Loosen the right and left steering rod end lock nuts.

Caution: To avoid possible damage to the union, always use a wrench to hold the tie rod end when loosening or tightening the steering rod end lock nut.

3. Adjust the steering rod to attain a correct front wheel alignment parameter.

Tip: When rotating one side of the steering rod lock nut outward or inward, the other side should be rotated in the same amount of threads outward or inward.



4. Check the front wheel alignment parameter again.
5. Tighten the lock nuts securing the steering rod LH and RH.
6. Make sure that the power steering gear protector is not strained or twisted.

Combination Switch

Warning: Before performing any operations related to the SRS system, be sure to read the applicable information thoroughly.

SRS Precaution

Warning: Before starting removing and repairing the SRS system, always remove the key from the ignition switch and disconnect the vehicle battery for more than 10 minutes.

Caution: Before disconnecting any components from steering system, ensure the wheels are held facing straight ahead and steering wheel should not turn. If it turns, the steering column lever combination switch could be damaged.

Removal

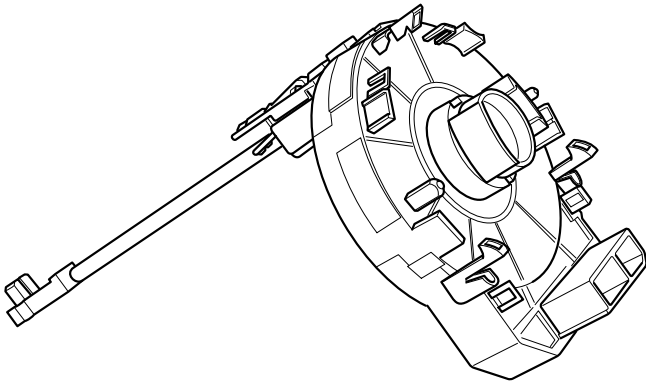
1. Disconnect the battery negative terminal.
2. Remove the steering wheel assembly.

Steering Wheel Assembly

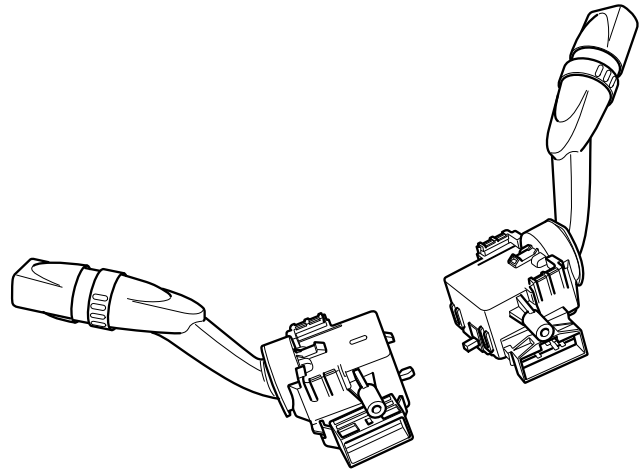
3. Remove the steering column protector.

Steering Column Protector

4. Disconnect the 3 connectors of the clock spring, windshield washer and wiper switch.
5. Remove the clock spring, and be careful not to damage the 3 claws.



6. Remove the windshield washer/wiper switch and the direction indicator switch separately, and be careful to prevent damage.



Refit

1. Make sure the front wheels face straight ahead. Position the clock spring and secure it to the steering column, then connect the connector.
2. Position the windshield washer/wiper switch and the direction indication switch separately and secure them to the steering column, then connect the connector.
3. Fit the steering column protector.

Steering Column Protector

4. Fit the steering wheel assembly.

Steering Wheel Assembly

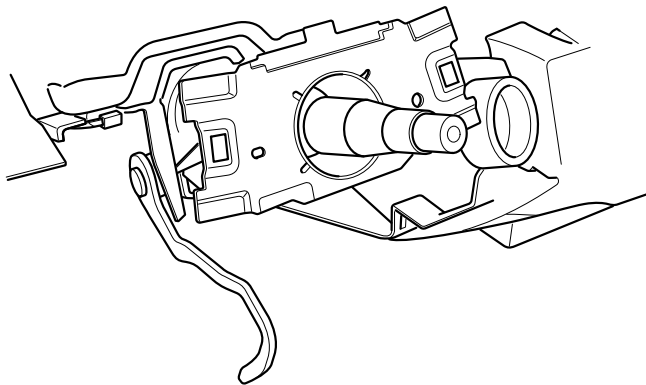
5. Connect the battery negative terminal.
6. Perform the system inspection, turn the combination switch, check if the **SRS** warning light turns on for 4 seconds, and then turns off.
7. Check if the steering main beam lever switch, wiper/washer switch and steering wheel control switch operate normally.

Steering Column Assembly**Removal**

1. Remove the key from the ignition switch and disconnect the battery earth lead, wait for 10 seconds, then disconnect the connection of the **SRS** backup circuit before performing the operation.
2. Remove the steering wheel assembly.

 **Steering Wheel Assembly**

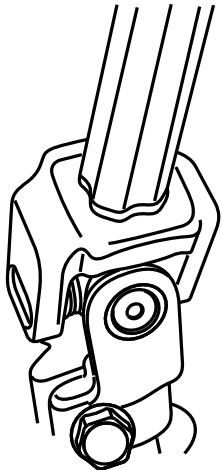
3. Remove the steering column trim panel.

 **Steering Column Protector**

4. Remove the steering column combination switch.

 **Combination Switch**

5. Move the floor carpet and slide the seal rearward, expose the bolt securing the steering column to the power steering gear.



6. Remove the bolt securing the steering column joint to the power steering gear input shaft and dispose of it.
7. Loosen the joint from the power steering gear.
8. Remove the 4 bolts securing the steering column to the instrument panel frame.
9. Remove the steering column assembly.

Refit

1. Position the joint onto the power steering gear input shaft to insure the correct position.
2. Tighten the joint by fitting the new lock nut and bolt,

tighten the bolt slightly.

3. Tighten the joint bolt to **18-25 Nm**.
4. Fit the bolt securing the steering column to the instrument panel frame and tighten it to **20-25 Nm**.
5. Position the steering knuckle seal and put the floor carpet to the original place.
6. Fit the steering column combination switch.

 **Combination Switch**

7. Fit the steering column trim panel.

 **Steering Column Trim Panel**

8. Fit the steering wheel assembly.

 **Steering Wheel Assembly**

9. Connect the battery earth lead.

Steering Column Trim Panel

Removal

1. Remove the driver side instrument side panel.

Instrument Side Panel Removal

2. Loosen the steering column to the lowermost position.
3. Separate the upper trim panel and lower trim panel slightly with a screwdriver, remove the steering column gap tape together with them.
4. Remove the 3 screws securing the steering column lower trim panel to the steering column.
5. Release the steering column adjusting handle and remove the steering column lower protector cover plate.
6. Remove the steering column upper protector from the steering column.

Refit

1. Position and secure the steering column lower protector cover with 3 screws to the steering column, tighten the screws to **1.3-1.9 Nm**.
2. Release the steering column lever and move the steering column to up position.
3. Place the top steering column protector cover onto the steering column and engage it to the lower protector carefully.
4. Fit the driver side instrument side panel.

Instrument Side Panel Refit

Wheel Alignment

Specifications

Parameter

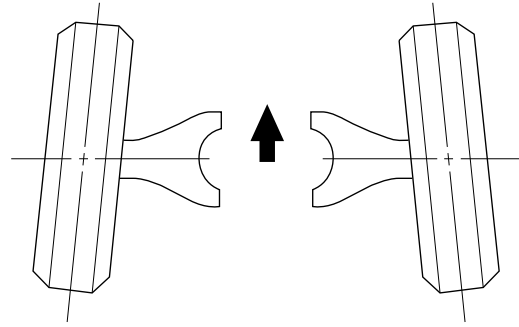
| Model | |
|---|------------|
| Wheel Alignment Parameter: | |
| Front Wheel | |
| Wheel Camber - Unload Condition | -0°12'±30' |
| Kingpin Caster - Unload Condition | 5°12'±30' |
| (Left and Right) Kingpin Caster Difference | 0°±30' |
| Kingpin Inclination | 13°3'±30' |
| (Left and Right) Kingpin Inclination Difference | 0°±30' |
| Total Toe-in - Unload Condition | 0°±12' |
| Toe-in | 0°±6' |
| Rear Wheel | |
| Wheel Camber - Unload Condition | -1°15'±30' |
| Thrust Angle | 0°±9' |
| Total Toe-in - Unload Condition | 0°30'±18' |
| Toe-in | 0°15'±9' |

Description and Operation

Description

The primary target of machine design is to ensure the safety and reliability of the steering system and suspension system. The strength of each component must be high enough to bear and absorb extreme impact. The steering system, front suspension system and rear suspension system must keep a certain geometric shape with the body. The steering system and suspension system require the front wheel to return automatically, which can keep the rolling force of the front wheel and the friction force of the road at a minimum level, allow the consumer to control the directions more easily and comfortably. The thorough inspection of the wheel alignment including measuring the toe-in and camber of the rear wheel. The four-wheel alignment can ensure that all four wheels rotate in the same direction. After geometric alignment, the vehicle can achieve the optimum fuel economy and tyre life, and improve the steering and performance.

5.1.2.1 Front Wheel Toe-in



S323001

Observe the front wheel toe-in from the top, the wheel rotates inward (or outward). Usually, the actual value of the toe-in angle is less than one degree, just several minutes. The purpose to specify the toe-in for the static wheels is to make sure the wheels can roll parallel while the vehicle is in dynamic condition. Excessive toe-in or toe-out may increase the wear of the wheels. For rear wheel drive vehicle, a smaller wheel toe-in angle (the value being measured when the vehicle is stationary) must be used to compensate the minute disturbance that generated because of the roll resistance and braking operation, and this disturbance makes the wheel have a tendency of expanding outward.

Service Procedures

Four-wheel Alignment

Caution: During the adjustment, the length of the outer steering rod LH and RH must be the same, otherwise, it will cause the tyres to wear unevenly.

Inspection

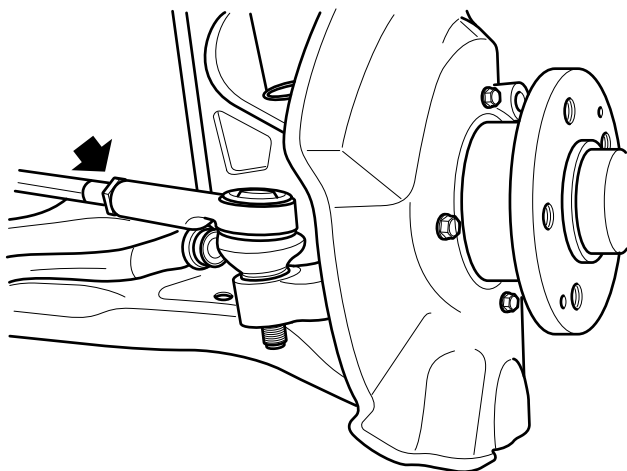
1. Only use the device approved by our company for the four-wheel alignment adjustment of the vehicle.
2. The device should be calibrated according to the requirements of the manufacturer.
3. Make sure the correct data of the vehicle have been input to the device.
4. Check the steering rod ball joint, the front lower ball joint and the bearings of the wheels for wear or rotate freely. Replace or repair them if necessary.
5. Check and adjust the tyre pressure.
6. Raise the vehicle on the four-wheel aligner.
7. Make sure the vehicle is in the curb weight condition.

General Information

8. Make sure the wheel mounting jig is adjusted to the correct dimension and fixed on the vehicle firmly.
9. Make sure the camera is fitted and aligned correctly.
10. Perform the alignment adjustment of the wheel according to the equipment manufacturing instruction manual. Lower the vehicle to make the vehicle suspension be in normal condition.
11. Make sure the steering wheel is in the centre position.

Adjustment

1. Observe the readings on the test device, and adjust the four-wheel alignment data as required.



2. Front wheel alignment adjustment:
 - Loosen the lock nuts on the steering rod.
 - Adjust the steering rod until the parameter of front wheel alignment equals the specified value.
 - Tighten the lock nuts to **58.8-78.4 Nm**.

- Repeat the steps mentioned above for the other side.

Front Suspension

Specifications

Torque

| Description | Value |
|---|------------|
| Nut - Front Shock Absorber to Steering Knuckle | 110-130 Nm |
| Bolt - Front Lower Arm to Steering Knuckle | 50-70 Nm |
| Nut - Connect Steering Gear Tie Rod to Steering Knuckle | 35-45 Nm |
| Screw - Front Disc to Bearing | 5-7 Nm |
| Bolt - Front Brake Caliper | 85-105 Nm |
| Screw - Secure Front Wheel Speed Sensor to Steering Knuckle | 8-12 Nm |
| Bolt - Brake Hose Secures Front Brake Caliper | 20-30 Nm |
| Screw - Front Brake Protector | 4-8 Nm |
| Bolt (Rear) - Front Lower Arm to Sub Frame | 110-130 Nm |
| Bolt (Front) - Front Lower Arm to Sub Frame | 110-130 Nm |
| Nut - Front Lower Arm to Steering Knuckle | 50-70 Nm |
| Nut - Top of Front Shock Absorber | 60-70 Nm |
| Nut - Anti Roll Bar Link to Anti Roll Bar | 40-60 Nm |
| Nut - Front Shock Absorber Assembly to White Body | 40-60 Nm |
| Bolt - Anti Roll Bar Bracket | 30-40 Nm |
| Nut - Fit Anti Roll Bar Link to Front Shock Absorber | 40-60 Nm |
| Bolt - Crash Bar to Sub Frame | 64-77 Nm |
| Screw - Front Sub Frame to White Body | 105-126 Nm |
| Nut - Crash Bar to Sub Frame | 64-77 Nm |
| Bolt - Crash Bar Refit | 36-43 Nm |
| Bolt - Adjust Front Sub Frame Strut Rod to Front Sub Frame | 34-63 Nm |

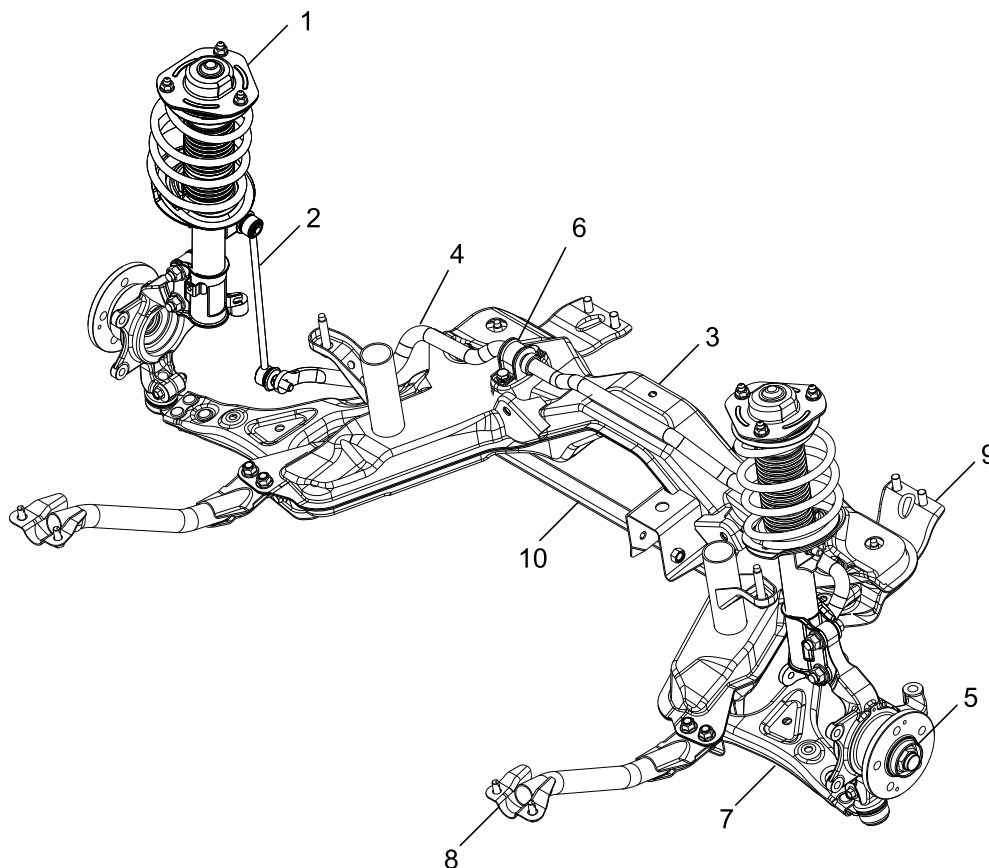
Parameter

| Model | |
|---|---|
| Front Lower Arm | The front suspension fixes the shock absorber and the "L" shape lower arm out of the front sub frame, which prevents the front suspension from tilting forward and backward |
| Anti Roll Bar Diameter | 22 ± 0.3 mm |
| Front Spiral Spring Data | |
| Total Turns | 4.8 |
| Effective Turns | 3.8 |
| Spring Wire Diameter | 12 mm |
| Free Length to Minimum Length While Working | 193.8-95 mm |

Description and Operation

System Component Layout

Front Suspension Component Layout



1. Front Suspension Shock Absorber Assembly

2. Anti Roll Bar Link

3. Front Sub Frame Assembly

4. Anti Roll Bar

5. Front Hub Assembly

6. Anti Roll Bar Bushing Clamp

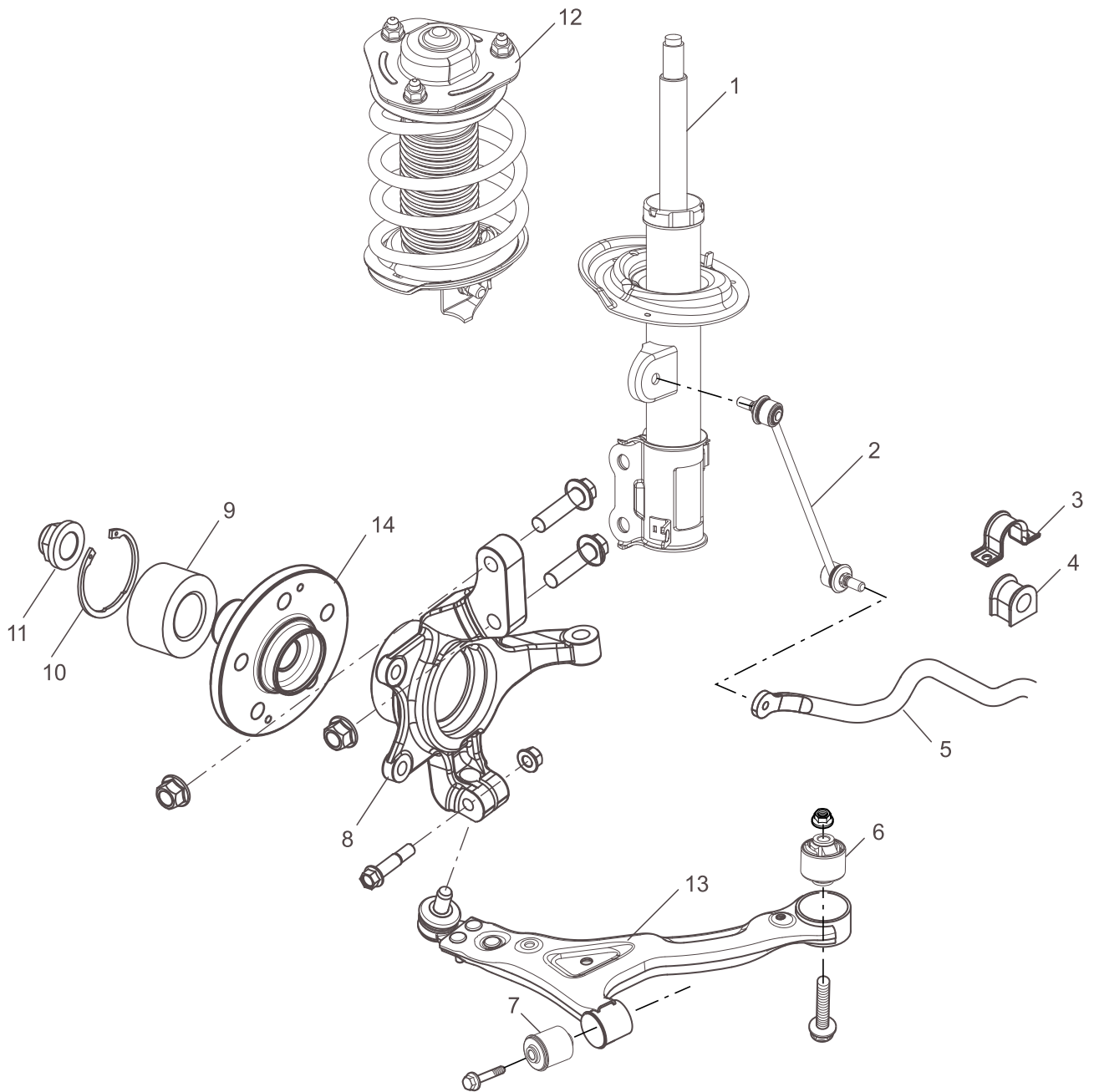
7. Front Lower Arm Assembly

8. Crash Bar Assembly

9. Sub Frame Rear Mounting Support Plate

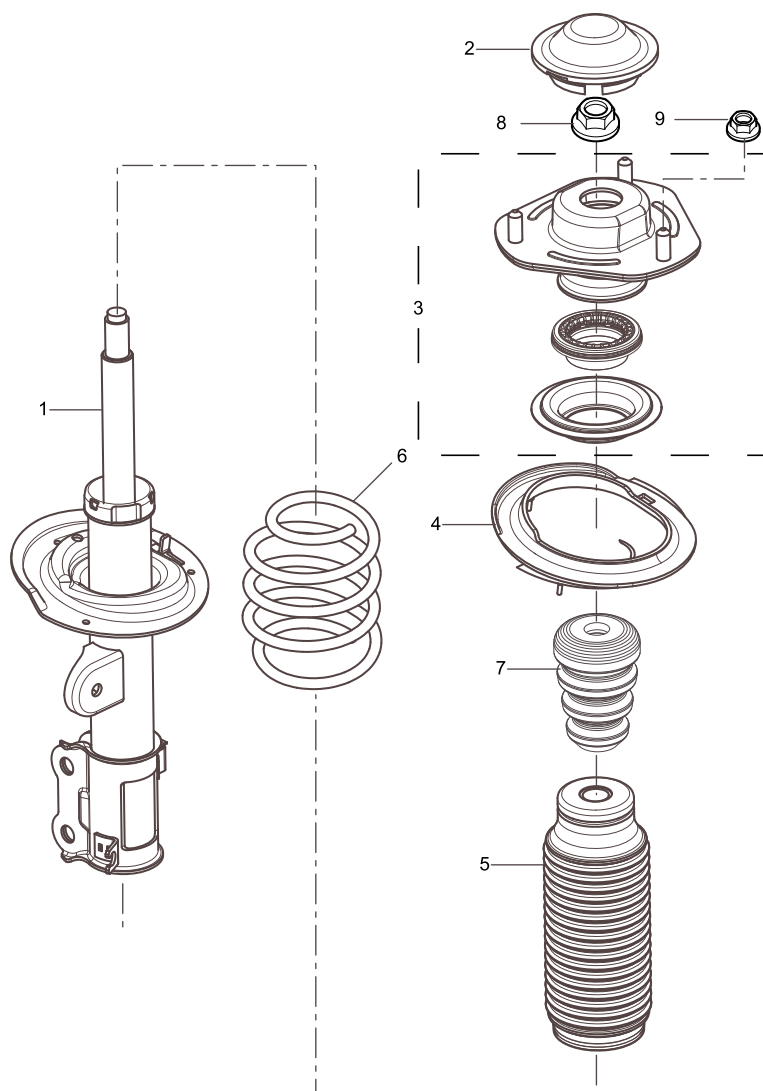
10. Front Sub Frame Strut Bar

Front Suspension Exploded View



- | | |
|----------------------------------|--|
| 1. Front Shock Absorber Pillar | 8. Front Hub |
| 2. Anti Roll Bar Link | 9. Front Hub Bearing |
| 3. Anti Roll Bar Holder Bracket | 10. Front Hub Elastic Backup Ring |
| 4. Anti Roll Bar | 11. Front Drive Shaft Nut |
| 5. Anti Roll Bar Bushing | 12. Front Shock Absorber Spiral Spring |
| 6. Front Lower Arm Front Bushing | 13. Front Lower Arm |
| 7. Front Lower Arm Rear Bushing | 14. Front Hub Flange |

Front Shock Absorber Exploded View



- | | |
|---|--|
| 1. Front Shock Absorber Pillar | 6. Front Suspension Spiral Spring |
| 2. Front Shock Absorber Insulation Cap | 7. Front Shock Absorber Pillar Assist Spring |
| 3. Front Shock Absorber Upper Support Seat Assembly | 8. Nut - Front Shock Absorber Top Support |
| 4. Front Shock Absorber Lower Spring Pad | 9. Nut - Front Shock Absorber Pillar to Body |
| 5. Front Shock Absorber Pillar Dust Cover | |

Description

The front suspension consists of:

- 2 Shock Absorbers
- 2 Front Lower Arms
- Anti Roll Bar
- 2 Anti Roll Bar Links
- Front Sub Frame
- Front Hub, Bearing and Drive Flange

The anti roll bar and the 1:1 shock absorber gear ratio make the design of the front suspension have the characteristic of pitching. Because of the adoption of lateral force compensation spring, the arrangement and design of the shock absorber minimizes the wheel camber loss caused by the lateral force applied to the shock absorber itself, improving the responsiveness of controlling and steering.

5.2.2.1 Front Sub Frame Assembly

The front sub frame with the characteristics of light weight and high structure strength is produced through stamping and welding. The geometric dimensions of all the key positions are machined after the front sub frame is produced, which can ensure the components of the front suspension and the steering system have accurate positions. The front sub frame strut rod equipped between the front sub frame front fulcrum and the body can improve the rigidity of the front sub frame. The arrangement of the fulcrum prevents the front sub frame from moving under lateral force, and the movement could lead to an unnecessary steering effect.

5.2.2.2 Front Shock Absorber Assembly

The front shock absorber adopts the inflated twin-tube structure, and can be inflated and refilled. This kind of twin-tube structure allows the shock absorber piston to move in the inner tube, and there is an oil discharge hole which is located between the inner tube and the outer tube on the inner tube, this structure minimizes possibility of the gas cavity phenomenon, and avoid affecting the piston's movement due to outer tube's damage. The lower end of the front shock absorber is connected to the front hub, and secured with the lock bolt. The bottom of the front shock absorber is fixed on the front hub to ensure a correct guide for front shock absorber. The front shock absorber column is seated in the bush rubber in which the steel plate inlaid, and the

bush rubber is integrated with the upper mounting carrier group. The front shock absorber column is tightened with the nut and washer. There is an outer hexagonal end face on the end of the front shock absorber column, which can be used to limit the column and prevent it from rotating when tightening the nuts of the front shock absorber column. The front shock absorber column is sealed in the shock absorber with low-friction material. The spring seat with a certain angle is integrated with the shock absorber body, and also can be used as the connection fitted point of the anti roll bar link.

5.2.2.3 Front Lower Arm Assembly

The front lower arm connects the front hub and the front sub frame. There is an outer ball joint with a straight pin on the front lower arm. The pin can be fitted on the opening of the front hub bottom, and clamped on the proper position with a bolt and a lock nut.

5.2.2.4 Anti Roll Bar and Link

The anti roll bar made of solid spring steel operates through the anti roll bar link, and the anti roll bar link is connected to the spring seat of the front shock absorber column. PTFE bushing is secured with the bolt and the anti roll bar holder bracket. The PTFE bushing has low friction, needs no extra lubrication and makes the anti roll bar rotate freely in static state, this makes the anti roll bar respond to the input of the rollover quickly, and the bushing with higher rigidity is allowed to be used when no compression and twist operation for the general bushing is found. The ripple washers seated on the anti roll bar, the outboard of each bushing can prevent the anti roll bar from moving towards the side direction. The tail end of the anti roll bar is connected to the spring seat of the front shock absorber through the anti roll bar link. The arrangement allows the anti roll bar to operate at a 1:1 rate with the wheels stroke in order to provide the maximum lateral stable efficiency. The ball joint is fitted on the end of each anti roll bar link, and the ball joint can improve the speed of response and efficiency. The upper ball joint fixed with the lock nut locates on the axial lead of the anti roll bar link, and connected to the front shock absorber spring seat directly. The link must be connected to the rear ball joint of the anti roll bar, and the lock surface of the lock nut should face the inside of the vehicle. The ball joints on the anti roll bar link cannot be repaired, and if any of them needs to be replaced, replace the anti roll bar link assembly with a new one.

Service Procedures

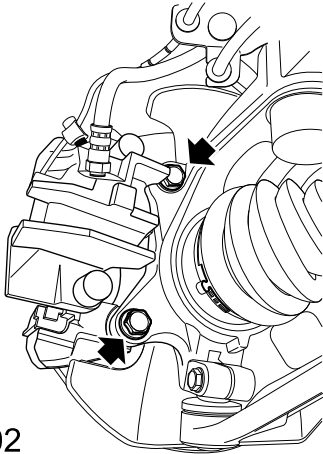
Front Hub Assembly

Removal

1. Raise the vehicle on a lift.

Wheel

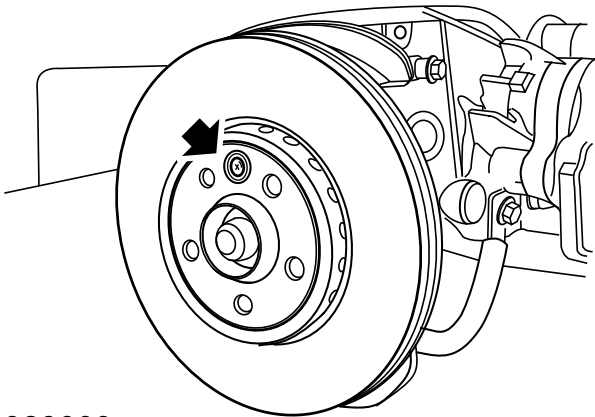
2. Remove the front wheel.
3. Loosen the brake hose from brake caliper.
4. Loosen the **ABS** sensor wire from the bracket.
5. Remove the 2 bolts securing the brake caliper to the front hub.



S323002

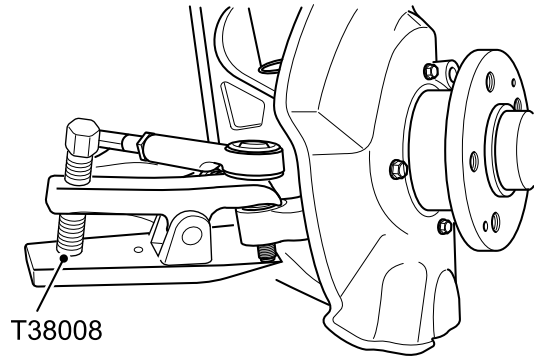
Caution: DO NOT hang the brake caliper on brake hose.

6. Remove the countersunk head screw securing the brake disc to the drive flange.



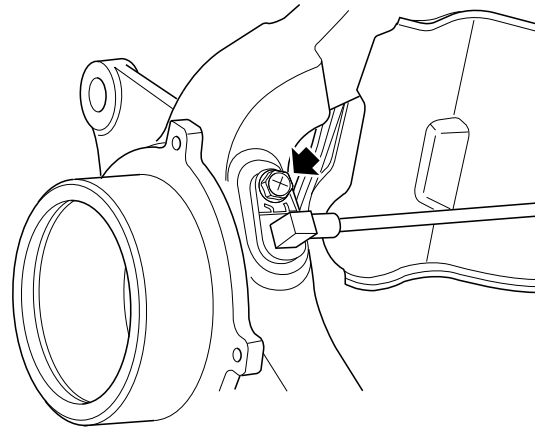
S323003

7. Remove the front disc.
8. Remove the nuts securing the steering rod to the steering knuckle.
9. Loosen the steering rod ball joint from the steering knuckle with the tool **T38008**.



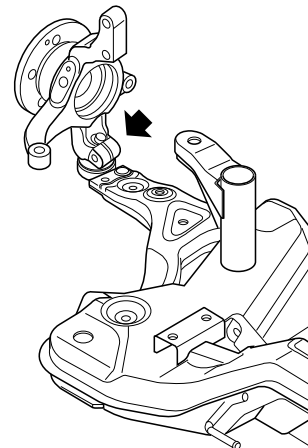
T38008

10. Remove the screw securing the **ABS** speed sensor, loosen the sensor and put it aside.



S323005

11. Remove the nuts and bolts securing the front lower arm outer ball joint to the front hub.



S323006

12. Fit the front lower arm ball joint protector.

Notice: Be sure to fit the ball joint protector to avoid damaging the ball joint.

13. Remove the bolts securing the front shock absorber assembly to the front hub.
14. Loosen the bolts connecting the wheel steering knuckle to the pillar and spring assembly.
15. Remove the front hub.

Caution: DO NOT place the rear hub bearings near the magnetic fields or chips, as it may damage the bearing.

Caution: DO NOT remove the protective cover from hub bearing unless the hub is about to be fitted.

Refit

1. Clean the connection of the front hub and the front shock absorber.
2. Clean the drive shaft assembly and the flange spline.
3. Clean the connection from the front hub to the front lower arm ball joint.
4. Fit the front hub to the front shock absorber assembly.
5. Connect the front hub to the front lower arm assembly.

Notice: DO NOT touch the front lower arm ball joint to prevent damaging it.

6. Fit the bolts securing the front shock absorber assembly to the front hub and tighten them to **110-130 Nm**.
7. Make sure that the front lower arm outer ball joint is fully engaged with the front hub, and the bolt is fitted in the groove of the front lower arm outer ball joint.
8. Fit the nuts and bolts securing the front lower arm assembly to the front hub, and tighten them to **50-70 Nm**.
9. Clean the connection of the steering rod and the steering knuckle.
10. Connect the steering rod to the steering knuckle, fit the lock nut and tighten it to **35-45 Nm**.
11. Fit the front disc to the front drive flange, fit the countersunk head screw and tighten it to **5-7 Nm**.
12. Loosen the front brake caliper assembly and position it to the front disc. Fit the bolts securing the front brake caliper to the front hub, and tighten them to **85-105 Nm**.
13. Secure the front brake hose to the front shock absorber jumper bracket with a tube clamp.
14. Secure the front wheel **ABS** sensor wire harness to the steering knuckle, and tighten the screw to **8-12 Nm**.
15. Tighten the 4 bolts securing the brake hose to the brake caliper to **20-30 Nm**.
16. Fit the wheels.

Wheel

17. Lower the vehicle.
18. Check the wheel alignment parameter.

Four-wheel Alignment

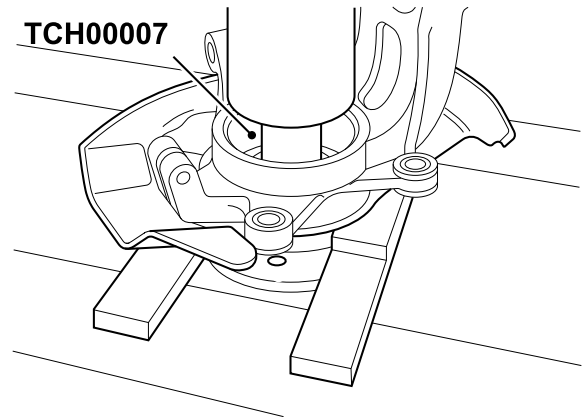
Front Hub Bearing

Removal

1. Remove the front hub assembly.

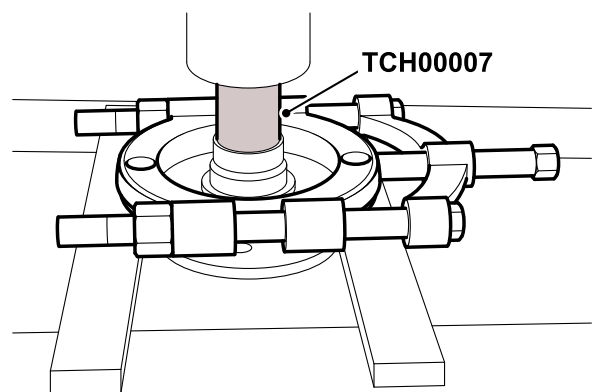
Front Hub Assembly

2. Remove the 3 bolts securing the front disc protector.
3. Position the front hub.



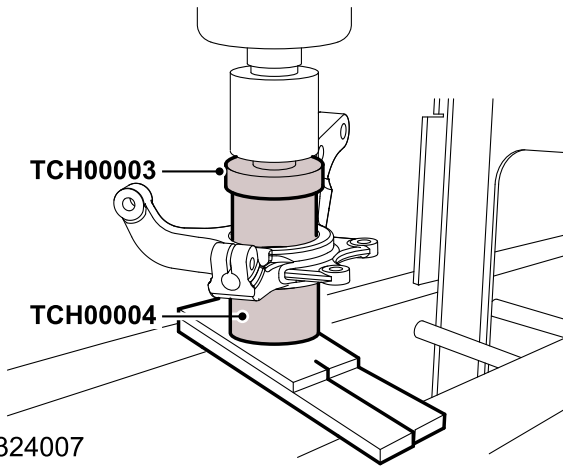
S323066

4. Fit the tool **TCH00007** to the front drive flange, then press the drive flange from the front hub bearing and separate it.
5. Remove the front disc protector.
6. Remove the bearing inner race from the drive flange with the tool **TCH00007**.



S324005

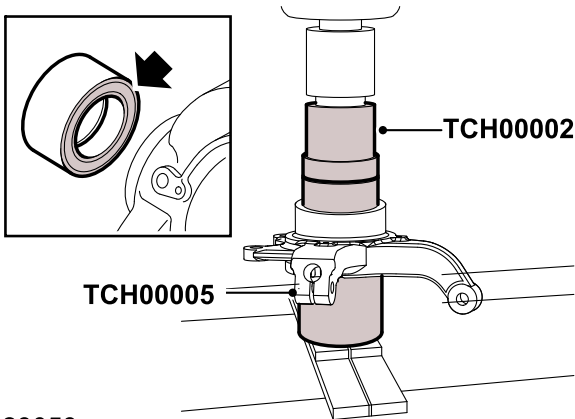
7. Remove the front hub bearing backup ring from the front hub.
8. Fit the tool **TCH00004** to the front hub bearing, and simultaneously press the bearing from the front hub with the tool **TCH00003**. Press the bearing from the front hub.



S324007

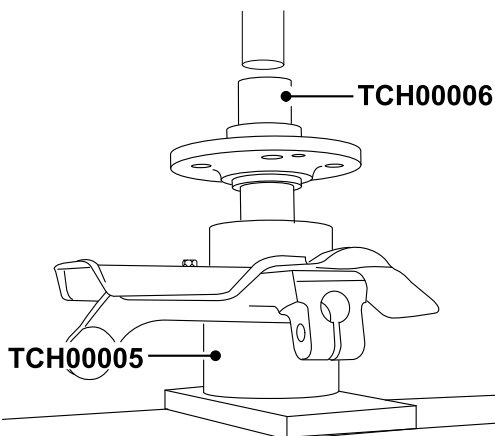
Refit

1. Clean the connection of the front hub and bearing.
2. Support the front hub on the tool **TCH00005**, and press in a new bearing with the tool **TCH00002**.



S323053

3. Fit the front hub bearing backup ring to the front hub.
4. Fit the front disc protector, and tighten the bolt to **4-8 Nm**.
5. Support the front hub bearing on the tool **TCH00005**, and press the drive flange into the front hub bearing with the tool **TCH00006**.



S324009

Front Lower Arm Assembly

Removal

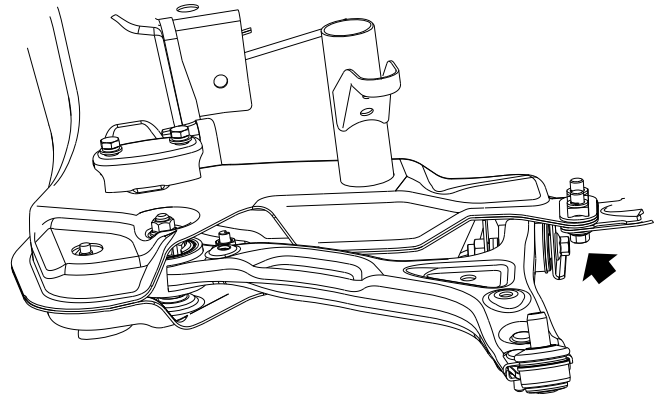
1. Raise the vehicle on a lift.
2. Remove the front wheel.



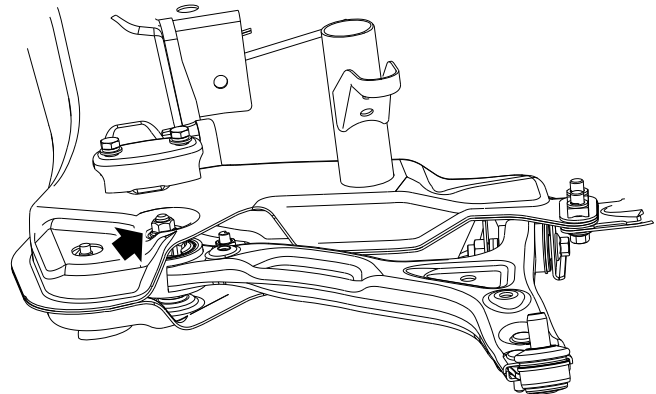
3. Loosen the lower arm outer ball joint from the front hub.
4. Fit the front lower arm outer ball joint protector.

Notice: Be sure to fit the ball joint protector to avoid damaging the ball joint.

5. Remove the nuts and bolts of the rear lower arm bushing and sub frame.



6. Remove the bolt from the front lower arm bushing to the sub frame welding nuts.



7. Remove the front lower arm assembly.

Refit

1. Connect the control arm rear bushing and the corresponding hole position of the sub frame with the bolts, tighten the nuts and bolts of the lower arm rear bushing and the sub frame to **110-130 Nm**.
2. Place the lower arm on the corresponding hole position of the sub frame, tighten the bolts of the welding nuts from the lower arm front bushing to the sub frame to **110-130 Nm**.
3. Remove the front lower arm ball joint protector, and check the ball joint protector for damage.
4. Connect the front lower arm outer ball joint to the front hub. Fit the nuts and bolts, and tighten the front

hub to **50-70 Nm**.

5. Fit the wheels.

 **Wheel**

6. Lower the vehicle.
7. Check the wheel alignment parameter.

 **Four-wheel Alignment**

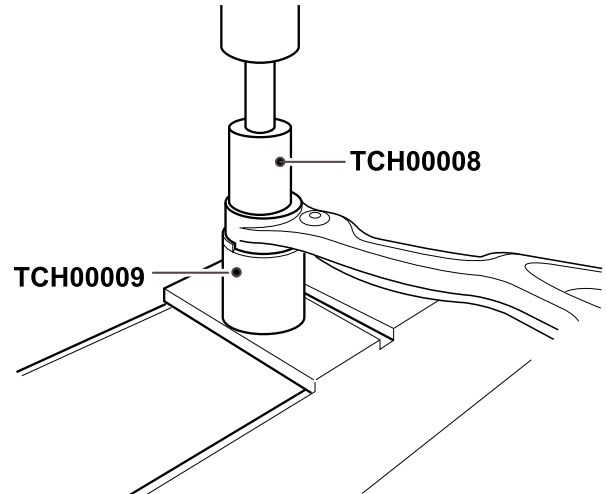
Front Lower Arm Rear Bushing

Removal

1. Remove the front lower arm

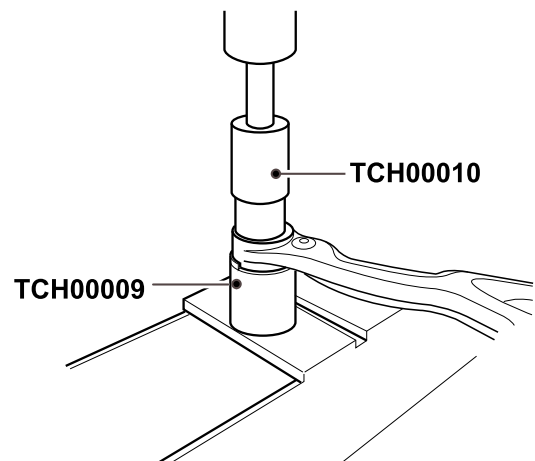
 **Front Lower Arm Assembly**

2. Remove the front lower arm bushing and the bracket assembly using the tools **TCH00008** and **TCH00009**.



Refit

1. Clean the connection of the front lower arm and the front lower arm bushing.
2. Position the front lower arm bushing on the front lower arm, make sure that the bushing aligns the mark on the front lower arm.
3. Press the front lower arm bushing onto the front lower arm using the tools **TCH00009** and **TCH00010**, until it aligns the mark on the front lower arm.



4. Fit the front lower arm assembly.

 **Front Lower Arm Assembly**

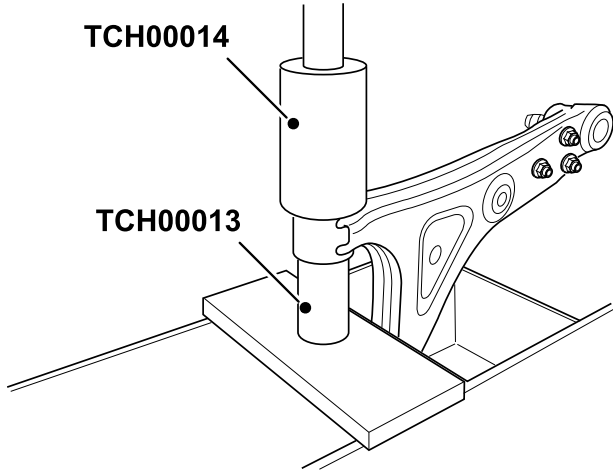
Front Lower Arm Front Bushing

Removal

1. Remove the front lower arm

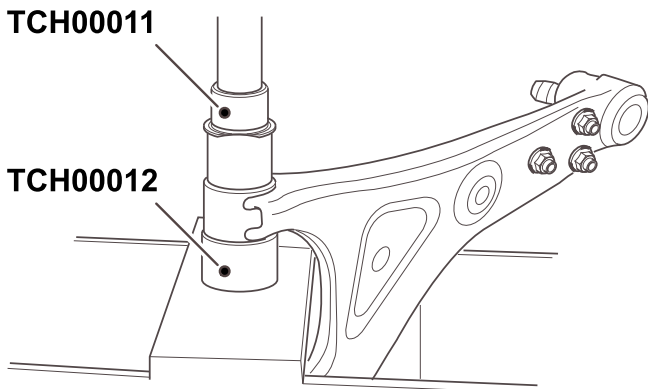
Front Lower Arm Assembly

2. Remove the front lower arm bushing and the bracket assembly using the tools **TCH00013** and **TCH00014**.



Refit

1. Clean the connection of the front lower arm and the front lower arm bushing.
2. Position the front lower arm bushing on the front lower arm, make sure that the bushing aligns the mark on the front lower arm.
3. Press the front lower arm bushing onto the front lower arm using the tools **TCH00011** and **TCH00012**, until it aligns the mark on the front lower arm.



4. Fit the front lower arm.

Front Lower Arm Assembly

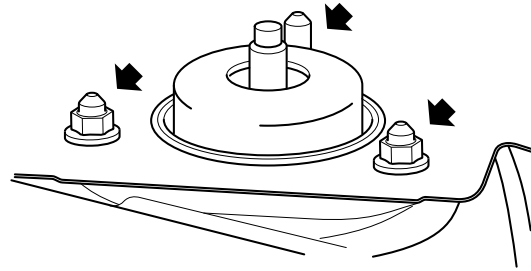
Front Shock Absorber Assembly

Removal

1. Raise the vehicle on a lift.
2. Remove the front wheel.

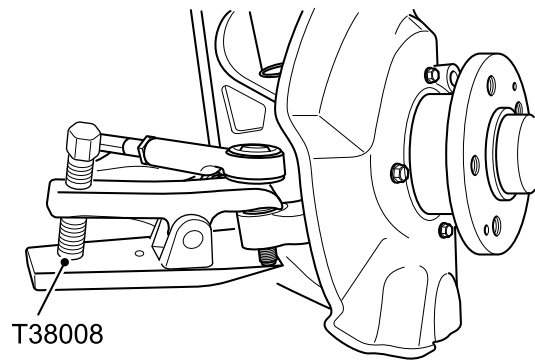
Wheel

3. Loosen the engine bay shock absorber column upper cover and the nuts.

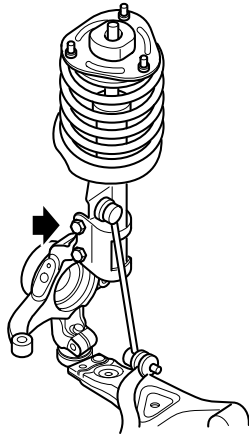


S323010

4. Loosen the **ABS** sensor wire harness and the brake hose from the front shock absorber. Loosen the wire harness and brake hose from the attaching clamp.
5. Remove the nuts from the anti roll bar link to the strut assembly, and disconnect the anti roll bar link.

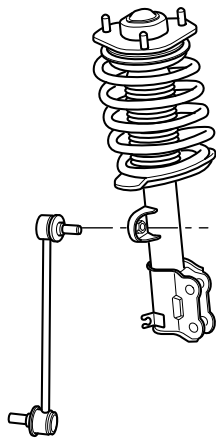


6. Remove the nuts and bolts from the steering knuckle to the shock absorber column assembly to disconnect the steering knuckle.



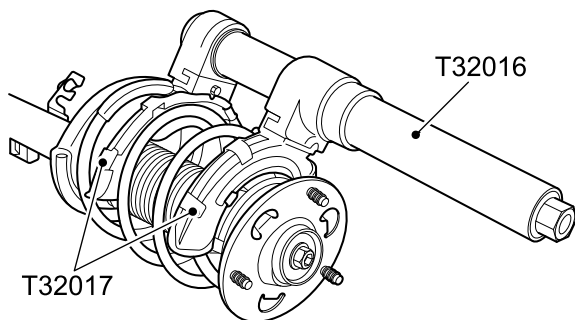
S323012

7. Remove the shock absorber column assembly.



S323013

8. Secure the spring compressor tools **T32016** and **T32017** to the front shock absorber spring.



S323021

9. Make sure that the spring compressor claw is positioned accurately, and compress the spring.
10. Pry the front shock absorber insulation cap, clamp the top of the front shock absorber column using the tools **T32016** and **T32017** and remove the nuts on the column top and dispose of them.
11. Remove the front shock absorber rebound washer and the front shock absorber upper mounting holder assembly.
12. Remove the spring insulator.

13. Remove the front shock absorber spiral spring.
14. Remove the front shock absorber compression travel block washer, the front shock absorber compression travel block and the front shock absorber dust cover.
15. Release the spiral spring pressure, loosen the claw from the spring compressor and remove the spiral spring.

Refit

1. Check the front shock absorber column, the upper and lower insulators of the spring, the bearing of the front shock absorber for crack and damage.
2. Check the front shock absorber dust cover and the front shock absorber compression travel block for signs of deterioration or damage.
3. Clean the front shock absorber column and the front shock absorber compression travel block washer.
4. Fit the front shock absorber compression travel block, the front shock absorber compression travel block washer and the front shock absorber column dust cover to the front shock absorber assembly.
5. Make sure that the front shock absorber compression travel block and the front shock absorber compression travel block washer are positioned on the front shock absorber column dust cover correctly.
6. Fit the front shock absorber spiral spring to the front shock absorber column.
7. Position the spring compressor on the front shock absorber, compress the spring with the tools **T32016** and **T32017**.
8. Make sure that the relative mounting position is correct, and fit the front shock absorber upper mounting holder and the front shock absorber spring insulator to the front shock absorber shaft.
9. Fit the front shock absorber rebound washer and the new nut.
10. Clamp the front shock absorber column using the inner hexagon wrench, and tighten the nut to **60-70 Nm**.
11. Release the elastic force of the spring, loosen the spring compressor claw and remove the spring compressor.
12. Connect the front shock absorber column assembly to the steering knuckle, and tighten the nuts and bolts from the steering knuckle to the front shock absorber column assembly to **110-130 Nm**.
13. Connect the anti roll bar link to the shock absorber column assembly, tighten the nuts from the anti roll bar link to the shock absorber column assembly to **40-60 Nm**.
14. Fit the front brake hose and the front wheel **ABS** sensor wire harness to the front shock absorber column bracket.

15. Fit the wheels.

 **Wheel**

16. Lower the vehicle.

17. Fit the engine bay shock absorber column upper cover and the nuts to **40-60 Nm**.

18. Check the wheel alignment parameter.

 **Four-wheel Alignment**

Anti Roll Bar

Removal

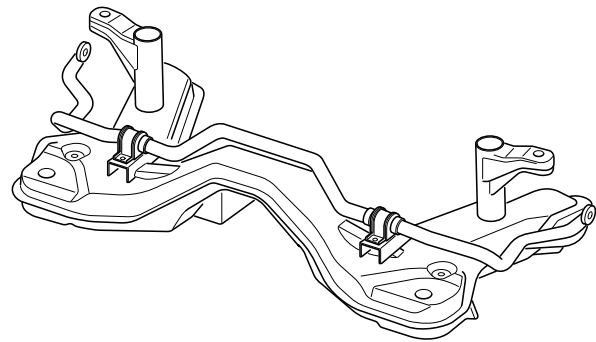
1. Raise the vehicle on a lift.
2. Remove the front wheel.

 **Wheel**

Caution: The nuts and bolts must be tightened when the weight of vehicle is applied to the suspension.

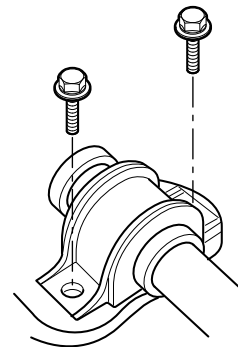
3. Remove the nuts securing the anti roll bar link to the anti roll bar.
4. Disconnect the anti roll bar link.
5. Remove the front sub frame assembly.

 **Front Sub Frame Assembly Removal**



S323015

6. Remove the 4 bolts securing the anti roll bar bushing bracket to the front sub frame assembly.



S323016

Refit

1. Secure the anti roll bar bushing bracket to the front sub frame, and tighten the bolts to **30-40 Nm**.
2. Fit the front sub frame assembly.

 **Front Sub Frame Assembly Refit**

3. Tighten the nuts from the anti roll bar to the anti roll bar link to **40-60 Nm**.
4. Fit the wheels.

Caution: The nuts and bolts must be tightened when the weight of vehicle is applied to the suspension.

Wheel

5. Lower the vehicle.
6. Check the wheel alignment parameter.

Four-wheel Alignment

Anti Roll Bar Bushing

Removal

1. Raise the vehicle on a lift.
2. Remove the front wheel.

Wheel

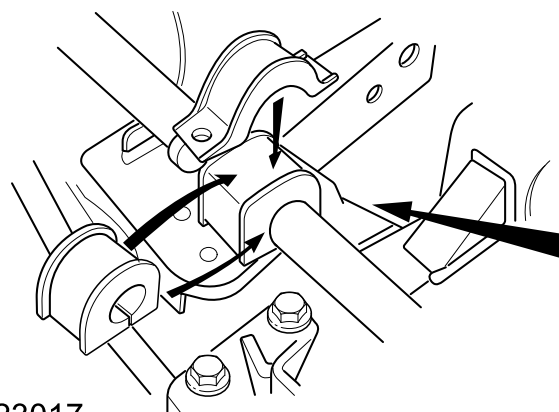
3. Remove the front sub frame assembly.

Front Sub Frame Assembly Removal

4. Remove the anti roll bar.

Anti Roll Bar

5. Remove the anti roll bar holder bracket and the bushing.



S323017

Refit

1. Fit the bushing to the anti roll bar and position it on the bracket.

Caution: Anti roll bar bushes have a special coating and must not be lubricated.

2. Fit the bushing holder bracket.
3. Fit the bolts securing the bushing bracket, and tighten each of them in order to **30-40 Nm**.
4. Fit the front sub frame assembly.

Front Sub Frame Assembly Refit

5. Fit the wheels.

Wheel

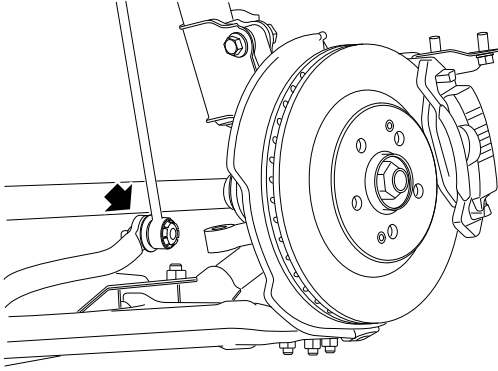
Anti Roll Bar Link

Removal

1. Raise the vehicle on a lift.
2. Remove the front wheel.

Wheel

3. Remove the nuts securing the anti roll bar link to the anti roll bar.



Front Sub Frame Assembly

Removal

1. Raise the vehicle on a lift.
2. Remove the front wheel.

Wheel

3. Remove the exhaust pipe.

Exhaust Pipe

4. Remove the engine rear lower tie bar.
5. Disconnect the steering rod from the steering knuckle assembly.
6. Disconnect the ball joint from the steering knuckle assembly.
7. Disconnect the anti roll bar from the front shock absorber assembly.

Notice: When removing the front service bolt, there must be two technicians holding the front crossmember assembly and supporting the assembly with the jack properly. Improperly supported front crossmember may cause personal injury.

S323018

4. Disconnect the anti roll bar link.
5. Turn the front shock absorber column to touch the set nuts on the anti roll bar link.
6. Remove the nuts securing the anti roll bar link to the front shock absorber.

Caution: To prevent damage to components, use two wrenches simultaneously when loosening or tightening the tube unions.

7. Remove the anti roll bar link from the front shock absorber.

Refit

1. Fit the anti roll bar link to the front shock absorber, and tighten the nuts to **40-60 Nm**.

Caution: To prevent damage to components, use two wrenches simultaneously when loosening or tightening the tube unions.

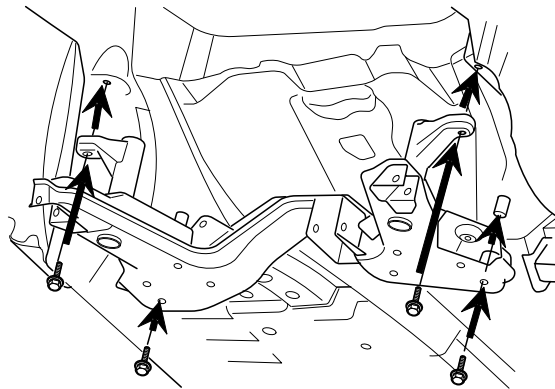
2. Connect the anti roll bar link to the anti roll bar, and tighten the nuts to **40-60 Nm**.
3. Fit the wheels.

Wheel

4. Lower the vehicle.
5. Check the wheel alignment parameter.

Four-wheel Alignment

8. Remove the 4 bolts securing the crash bar to the white body.
9. Remove the 4 mounting bolts securing the front sub frame support plate.



S323020

10. Remove the 4 screws securing the front sub frame to the white body.
11. Remove the front sub frame assembly from the vehicle.
12. Remove the 4 bolts securing the crash bar to the front sub frame.

Refit

1. Tighten the 4 bolts securing the crash bar to the front sub frame to **64-77 Nm**.
2. Adjust the sub frame to a proper position to insert the mounting shaft of the body to the two mounting points behind the sub frame.
3. Tighten the 4 bolts securing the front sub frame to the white body to **105-126 Nm**.

4. Tighten the 4 bolts securing the front sub frame bracing plate to **64-77 Nm**.
5. Tighten the 4 bolts securing the crash bar to the white body to **36-43 Nm**.
6. Adjust the front sub frame support to the front sub frame, and tighten the bolt to **34-63 Nm**.
7. Connect the anti roll bar to the front shock absorber column assembly.
8. Connect the ball joint to the steering knuckle assembly.
9. Connect the steering rod to the steering knuckle assembly.
10. Fit the exhaust pipe to the vehicle.

Exhaust Pipe

11. Fit the wheels.

Wheel

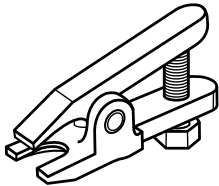
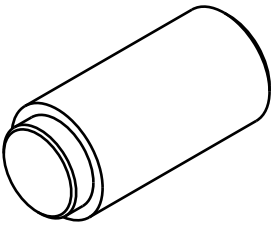
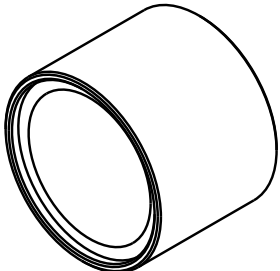
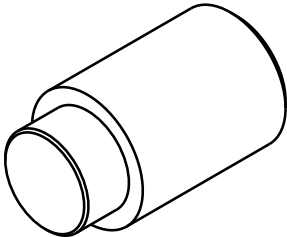
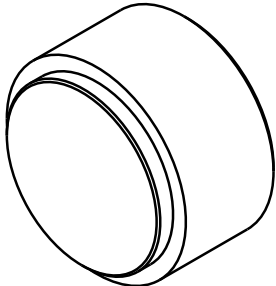
12. Lower the vehicle.
13. Check the wheel alignment parameter.

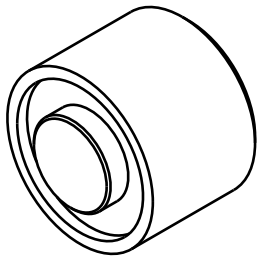
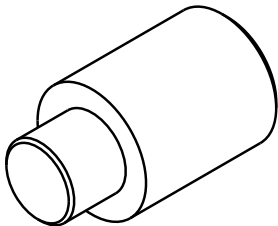
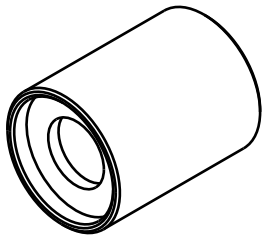
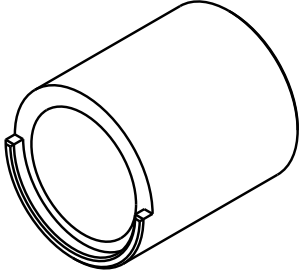
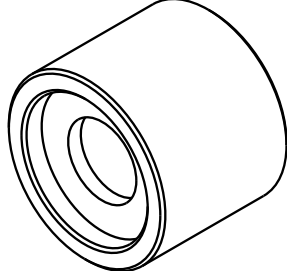
Four-wheel Alignment

Suspension System

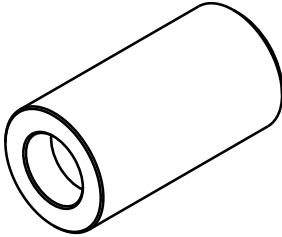
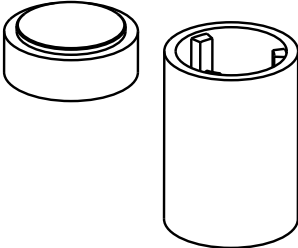
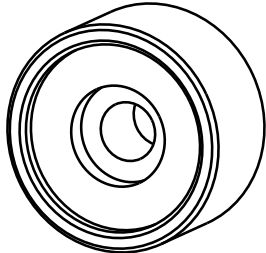
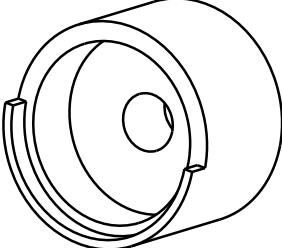
Front Suspension

Special Tools

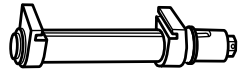
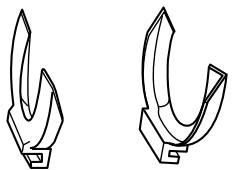
| Tool Number | Description | Picture |
|-------------|---|---|
| T38008 | Ball Joint Removal Fixture |  T38008 |
| TCH00007 | Front Hub Drive Flange Remover |  TCH00007 |
| TCH00004 | Front Hub Bearing Removal Support |  TCH00004 |
| TCH00003 | Front Hub Bearing Remover |  TCH00003 |
| TCH00005 | Front Hub Bearing and Drive Flange Mounting Support |  TCH00005 |

| Tool Number | Description | Picture |
|-------------|---------------------------------------|---|
| TCH00002 | Front Hub Bearing Replacer |  TCH00002 |
| TCH00006 | Front Hub Drive Flange Replacer |  TCH00006 |
| TCH00008 | Front Arm (big) Bush Remover |  TCH00008 |
| TCH00009 | Front Arm (big) Bush Replacer Support |  TCH00009 |
| TCH00010 | Front Arm (big) Bush Replacer |  TCH00010 |

Front Suspension

| Tool Number | Description | Picture |
|-------------|---|---|
| TCH00013 | Front Arm (small) Bush Remover |  <p>TCH00013</p> |
| TCH00014 | Front Arm (small) Bush Removal Support |  <p>TCH00014</p> |
| TCH00011 | Front Arm (small) Bush Replacer |  <p>TCH00011</p> |
| TCH00012 | Front Arm (small) Bush Mounting Support |  <p>TCH00012</p> |

Suspension System

| Tool Number | Description | Picture |
|-------------|--|---|
| T32016 | Front Suspension Spring Compressor |  <p>T32016</p> |
| T32017 | Front Suspension Spring Compressor Adaptor |  <p>T32017</p> |

Rear Suspension**Specifications****Torque**

| Description | Value |
|--|------------|
| Bolt - Rear Suspension Shock Absorber to Torsion Beam | 130-150 Nm |
| Nut - Rear Suspension Shock Absorber to White Body | 40-60 Nm |
| Screw - Rear Disc to Bearing | 5-7 Nm |
| Bolt - Rear Brake Caliper to Universal Joint | 55-65 Nm |
| Screw - Secure Rear Wheel Speed Sensor to Steering Knuckle | 8-12 Nm |
| Bolt - Rear Torsion Beam Fitting Assembly to Body | 90-110 Nm |
| Bolt - Secure Hand Brake Cable Clamp | 19-25 Nm |
| Bolt - Steel On-Road Wheel | 115-130 Nm |

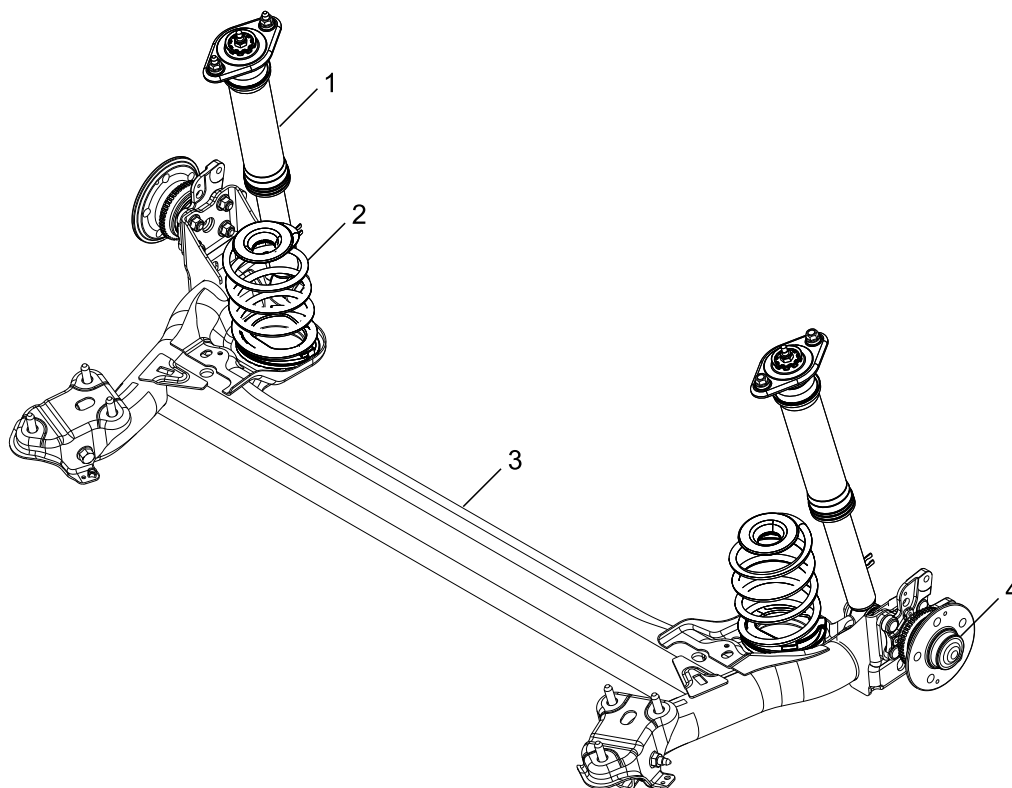
Parameter

| Model | |
|--------------------------|--------|
| Rear Spiral Spring Data: | |
| Coil Total Number | 6.8 |
| Effective Turns | 4.1 |
| Spring Wire Diameter | 11 mm |
| Free length | 315 mm |

Description and Operation

System Component Layout

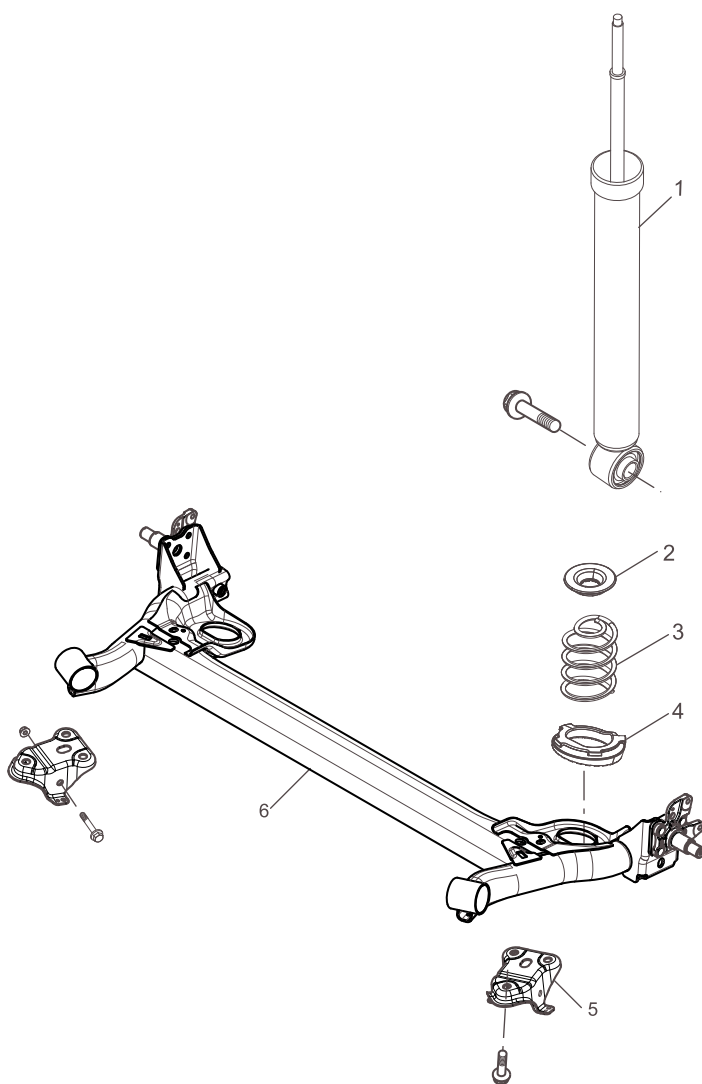
Rear Suspension Component Layout



- 1. Rear Shock Absorber Assembly
- 2. Rear Suspension Spiral Spring Assembly

- 3. H Torsion Beam Assembly
- 4. Rear Hub Assembly

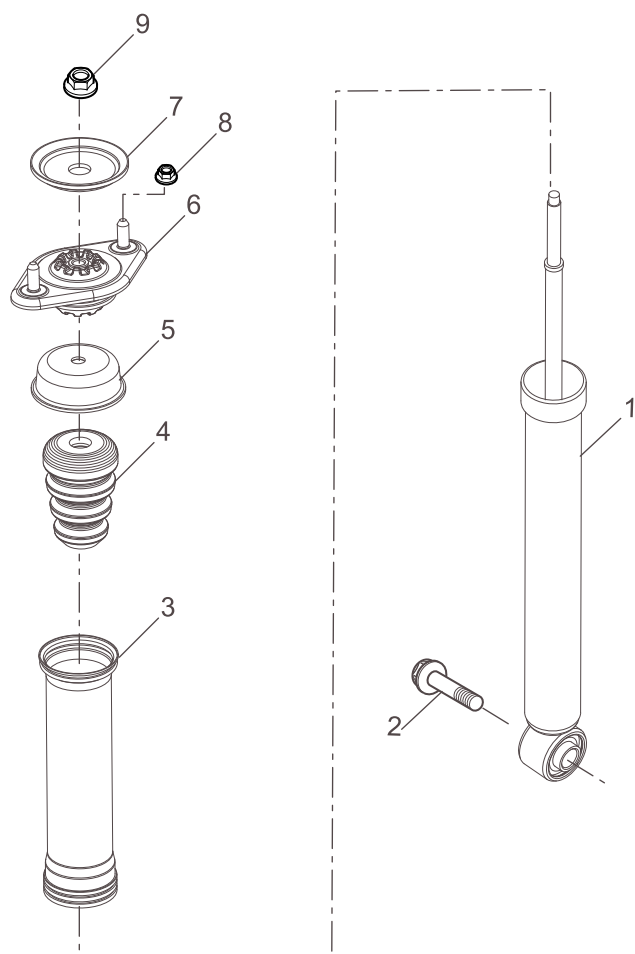
Rear Suspension Exploded View



- 1. Rear Suspension Shock Absorber Assembly
- 2. Rear Suspension Upper Spring Shock Isolator
- 3. Rear Suspension Spring

- 4. Rear Suspension Lower Spring Shock Isolator
- 5. H Torsion Beam Mounting Bracket Assembly
- 6. H Torsion Beam Assembly

Rear Shock Absorber Exploded View



- | | |
|--|--|
| 1. Rear Suspension Shock Absorber Pillar | 6. Rear Shock Absorber Top Support Assembly |
| 2. Bolt - Rear Suspension Shock Absorber | 7. Rear Shock Absorber Rebound Washer |
| 3. Rear Suspension Shock Absorber Dust Cover | 8. Nut - Rear Suspension Shock Absorber to White Body |
| 4. Rear Shock Absorber Assist Spring | 9. Nut - Rear Suspension Shock Absorber to Top Support |
| 5. Cushion Washer - Rear Suspension Shock Absorber | |

Description

The rear suspension consists of:

- 2 Spiral Springs
- 2 Shock Absorber Assemblies
- H Torsion Beam

5.3.2.1 H Torsion Beam Type Suspension

There is a pair of suspension trailing arms extending to the front and rear of the vehicle, and they can securely support the body by front end shake, and support the rear wheels freely by rear end rotation; The torsion beam extends along the transverse direction of the vehicle, and each end in the longitudinal direction connects to the middle part in the front and rear direction of the suspension trailing arms above respectively, and the spiral spring sets on the corner formed by the each end in the longitudinal direction of the torsion beam above and the rear of the suspension trailing arms above, and secured on the torsion beam and the suspension trailing arms above, and the rear of the spring has a spiral spring mounting seat; The shock absorber mounting seat used for fitting the shock absorber is set on the rear of the

spiral spring mounting seat above; The spring seat mentioned above has a lower plate used for supporting the spiral spring and connected to the suspension trailing arm, but it is not connected to the torsion beam, and the seat also has a flange bending upward from the lower plate and connected to the torsion beam and the suspension trailing arm. The flange part has rib reinforcements extending from the surround of the shock absorber mounting seat to the rear.

5.3.2.2 Spiral Spring

The spiral spring made of chrome steel is fitted between the body and the rear lower arm and each of them is fitted between the upper and the lower spring insulators, which can reduce the noise transferred from the suspension to the body. Each insulator is connected to the spring directly. The lower insulator is fitted in a flat hole on the rear torsion beam, and positioned through a straight line. The cutting opening in the lower insulator is used for draining water, and when assembling, the hole should be aligned with the corresponding one on the rear torsion beam, and the linear part in the hole needs an alignment for an easy assembly.

Service Procedures

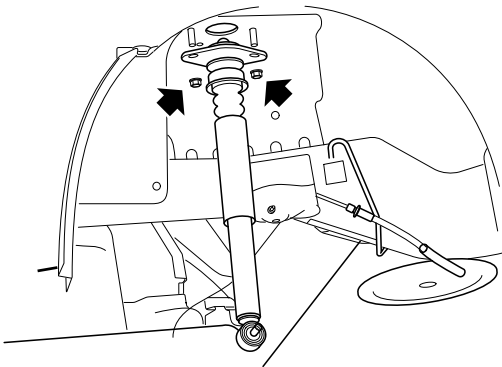
Rear Shock Absorber Assembly

Caution: When replacing the two shock absorbers, only one can be removed each time. **DO NOT** hang the rear axle with the brake hose, otherwise, the brake hose may be damaged.

Caution: Be sure to support the torsion beam with the adjustable jack stand when lifting the vehicle with the body lift.

Removal

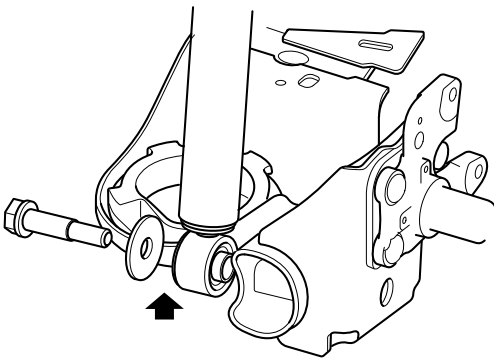
1. Remove the bolts from the shock absorber to the upper body.



the bolt to **40-60 Nm**.

S323021

2. Lift up the vehicle and support the torsion beam.
3. Remove the bolts from the lower shock absorber to the torsion beam.



S323022

4. Remove the shock absorber.

Refit

1. Pass the bolt of the lower shock absorber to the torsion beam through the shock absorber lower connection carrier and insert it into the torsion beam, and tighten the bolt to **130-150 Nm**.
2. Lower the vehicle to proper height to insert the upper shock absorber stud into the corresponding opening on the body, and loosely fit the service bolt, and tighten

Rear Suspension Spring Assembly

Removal

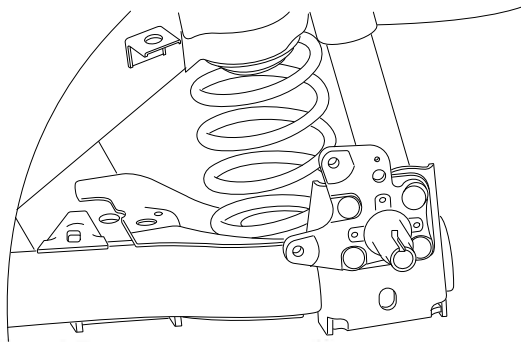
1. Remove the rear wheels.



Wheel

Notice: The upper insulator must be fitted on the body and kept in position during the process of lifting the axle assembly and spring before fitting the spring.

2. Lift and support the vehicle properly, support the rear control arm using the jack bracket.
3. Remove the left and right shock absorber lower bolts.
4. Lower the torsion beam and remove the spring and upper insulator.



S323023

Refit

1. Fit the upper insulator and secure the lower shock absorber block.
2. Fit the spring and lift the torsion beam.
3. Fit the shock absorber.



Rear Shock Absorber Assembly

4. Fit the wheels.



Wheel

5. Remove the jack bracket and lower the vehicle.

Rear Wheel Hub Bearing

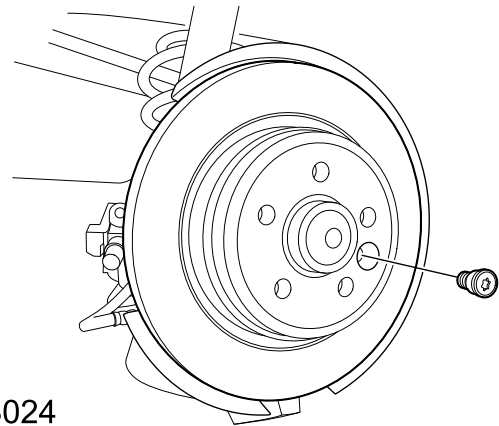
Removal

1. Lift the vehicle.
2. Remove the rear tyre.



Wheel

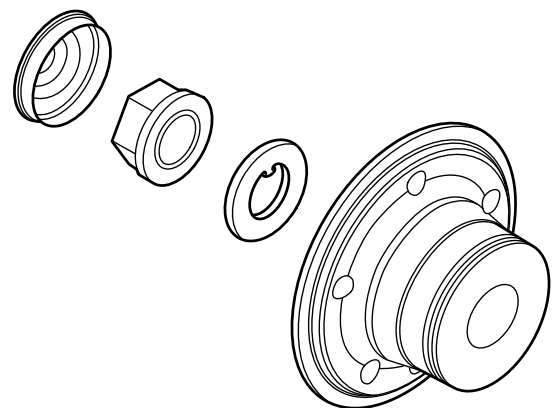
3. Loosen the screw securing the sensor to the rear wheel bracket.
4. Remove the bolt securing the hub to the wheel bracket.



S323024

Caution: DO NOT hang the brake caliper on brake hose.

5. Remove the countersunk head screw securing the rear brake disc to the rear hub.
6. Remove the rear brake disc.
7. Remove the rear hub grease cap from the rear hub assembly and dispose of it.



S323025

8. Pry up the rear wheel bracket nut stake.
9. Remove the rear wheel bracket nut and dispose of it.
10. Remove the rear hub washer from the short shaft.
11. Remove the rear hub bearing.

Caution: DO NOT place the rear hub bearings near the magnetic fields or chips, as it may damage the bearing.

Refit

1. Clean the wheel bracket.
2. Fit the rear hub assembly to the rear wheel bracket.

Caution: *DO NOT remove the protective cover from hub bearing unless the hub is about to be fitted.*

3. Fit the rear hub washer to the rear wheel bracket.
4. Clean the mating surface of the rear drum type brake ventilated disc and the rear hub assembly.
5. Fit the rear drum type brake ventilated disc to the rear hub assembly, fit the countersunk head screw and tighten it to **5-7 Nm**.
6. Fit the brake caliper assembly and position it on the rear disc, and then tighten the bolt to **55-65 Nm**
7. Insert the tip of the sensor into the rear wheel bracket, tighten the screw following the torque to **8-12 Nm**.
8. Fit the wheels.

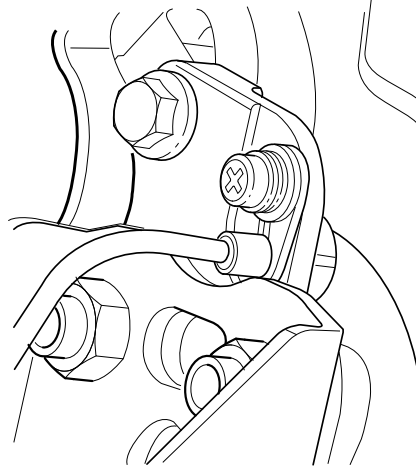
 **Wheel**

9. Lower the vehicle.

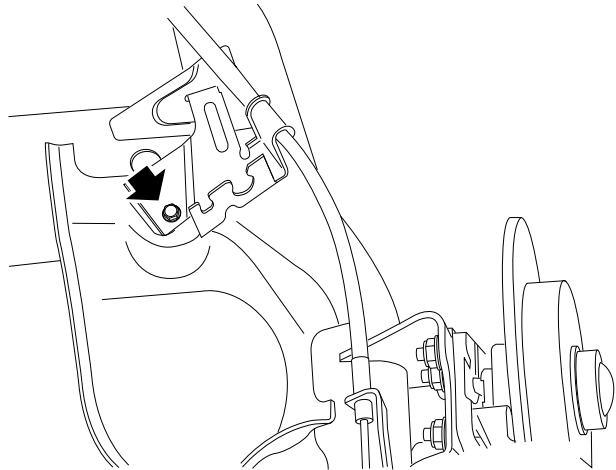
Torsion Beam Assembly

Removal

1. Lift the vehicle.
2. Remove the rear tyre.
3. Disconnect the **ABS** connector.



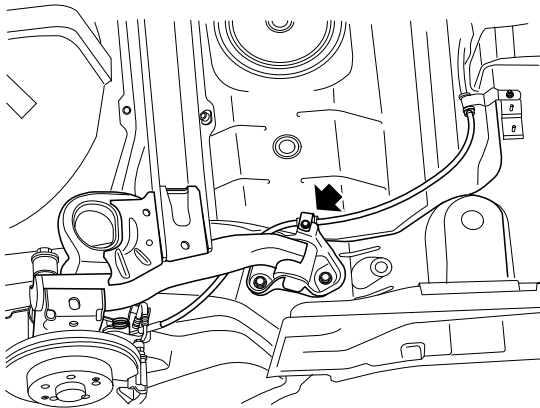
4. Remove the bolt securing the bracket to the rear torsion beam, loosen the brake hose LH.



5. Disconnect the brake hose LH.

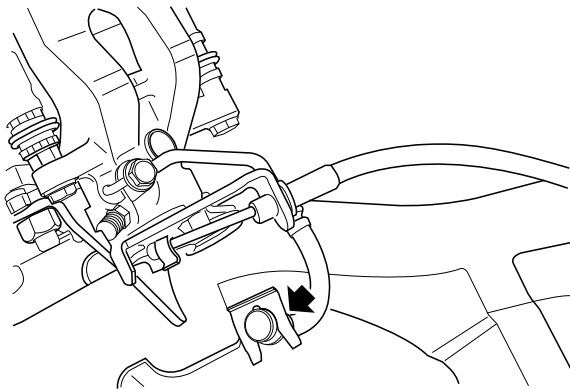
Caution: *Plug the disconnected unions to prevent contamination entering.*

6. Remove the 2 bolts on the bottom of the shock absorber.
7. Remove the 2 bolts securing the hand brake cable to the sub frame. Put the cable aside so that the torsion beam can be removed.



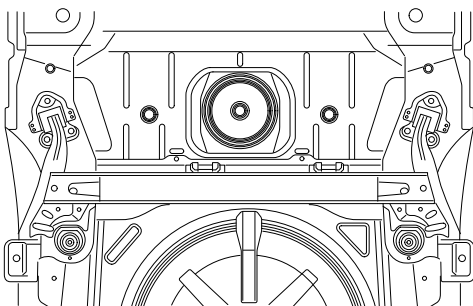
S402012

8. Loosen the clamp securing the cable tie to the rear brake caliper.



S402013

9. Repeat the steps mentioned above for the other side.
10. Compress and remove the 2 rear suspension springs, stow the spring insulator.
11. Support the sub frame.
12. Remove the 8 bolts securing the torsion beam to the body.



S323026

13. Remove the H torsion beam.

Refit

1. Clean the mating surface between the sub frame and the body.

2. Position the sub frame on the body using the hydraulic lift device.
3. Fit the bolts securing the torsion beam to the body, and tighten them to **90-110 Nm**.
4. Fit the bolts securing the hand brake cable clamp and tighten them to **19-25 Nm**.
5. Fit the 2 rear spring assemblies.
6. Fit the 2 shock absorbers and tighten the bolt to **130-150 Nm**.
7. Connect the 2 brake tubes.
8. Secure the connector to the sub frame.
9. Connect the **ABS** sensor.
10. Connect the hand brake cable to the hand brake cable tension device.
11. Bleed the brake system.

 **Brake System Bleeding**

12. Fit the 2 rear wheels, and tighten the bolts to **115-130 Nm**.
13. Perform the four-wheel alignment on the vehicle.

 **Four-wheel Alignment**

Tyres and Wheels**Specifications****Torque**

| Description | Value |
|------------------|------------|
| Bolt -Road Wheel | 115-130 Nm |

Parameter

Wheel and Tyre

| | |
|-------------|----------------|
| Wheel Size: | |
| Alloy | 6.5J × 16 |
| Steely | 6.5 × 16 |
| Tyre Size: | 205/55 R16 91V |
| Spare Tyre | 205/55 R16 91V |

Note: The tyre size is printed on the outer tyre bead of each tyre. Tyre Pressure

| | | |
|---|-------|---------|
| Tyre Pressure - Normal Operation Status | Front | 2.1 bar |
| | Rear | 2.1 bar |
| Tyre Pressure - High Speed (Exceeds 100 mph (160 km/h)) | Front | 2.1 bar |
| | Rear | 2.1 bar |

Tip: Normal driving conditions: Carry up to 4 passengers and luggage.

Service Procedures

Wheel

Warning: *DO NOT lubricate the rim or tyre edge with silicone lubricant. Clean the tyre edge area before removing the tyre, and lubricate this area thoroughly with 50% lubricant and 50% water before fitting.*

Removal

1. Remove the wheel trim cap assembly with the screwdriver.
2. Remove the 5 steely road type wheel bolts using the socket wrench in the tool kit.
3. Put the vehicle on the lift and raise a certain height.
4. Remove the wheel.
5. Remove the tyre and the wheel air valve assembly.

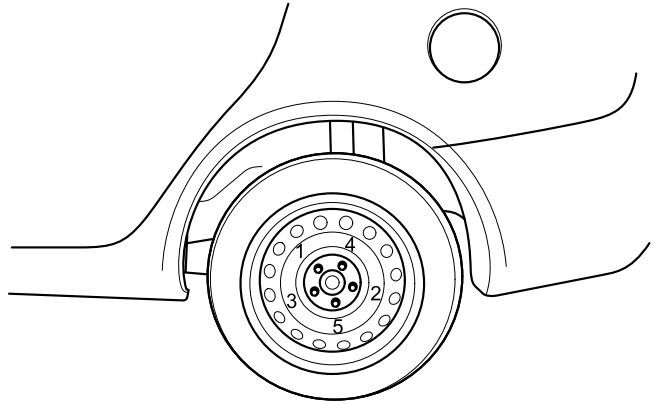
Warning: *Use a tyre changer to remove the tyre. Only use manual tools or pry bar could damage the tyre bead and rim.*

Caution: *DO NOT place the hub panel face downward on the ground to avoid scratching.*

Refit

Caution: *Please remove the corrosive on the wheel fitting surface, brake drum and brake disc fitting surface with the scraper or wire brush before fitting the wheel. When fitting the wheel, improperly connecting the metal fitting surface and metal will cause the wheel bolts loose. This will cause the wheel off while the vehicle is moving, so that the vehicle is out of control, which may lead to injury.*

1. Fit the wheel air valve assembly.
2. Fit the tyre using the tyre changer, and inflate the tyre until the tyre bead stays in place. Make sure that the set ring on the outside of the tyre bead appears around the projecting edge of the rim on the both sides of the wheel. This method of tyre alignment can ensure that the tyre bead stays in place correctly.
3. Perform the dynamic balance of the wheel again, match and fit the new wheel balance block.
4. Fit the wheel, tighten the 5 steely road type wheel bolts to **115-130 Nm**, the sequence of tightening is as follows (1 to 5).



Warning: *If there is oil leakage between the wheel and the brake disc or drum, it will cause the wheel loose during driving and result in injury with the vehicle out of control. Never use heating method to remove a seized wheel. This will shorten the life of wheel, wheel bolts, hub and bearing assembly. Tighten the wheel nuts to correct torque in sequence, to avoid distortion of wheel, brake drum or disc.*

5. Fit the wheel trim pad assembly.

Brake Specifications

Torque

| Description | Value |
|---|-----------|
| Nut - Master Cylinder to Vacuum Booster | 21-29 Nm |
| -Brake Hard Tube Brake Master Cylinder | 20-24 Nm |
| Nut - Vacuum Booster to Body | 8-18 Nm |
| -Brake Hard Tube to Master cylinder | 20-24 Nm |
| Bolt - Pedal Mounting Bracket | 8-18 Nm |
| Nut - Pedal Assembly to Dash Lower Panel | 8-18 Nm |
| Bolt -Accelerator Pedal Secured to Dash Panel | 4-8 Nm |
| Bolt - Stop Lamp Switch secured to Brake Pedal | 8-12 Nm |
| Bolt -Brake Caliper Assembly | 90-110 Nm |
| -Front Brake Hose to Brake Caliper Housing | 20-30 Nm |
| Screw - Front Brake Exhaust | 9-11 Nm |
| Screw - Front Brake Ventilated Disc to Front Hub Flange | 5-7 Nm |
| Bolt - Front Brake Caliper to Front Hub | 85-105 Nm |
| Screw - Rear Brake Ventilated Disc to Rear Bearing | 5-7 Nm |
| Bolt - Rear Brake Caliper to Rear Hub | 85-105 Nm |
| -Rear Brake Hose to Brake Caliper Housing | 20-30 Nm |
| Screw - Rear Brake Exhaust | 9-11 Nm |
| Bolt -Electronic Vacuum Pump Support to Longitudinal Member | 19-25 Nm |
| Bolt -Electronic Vacuum Pump to Mount Support | 8.8 Nm |

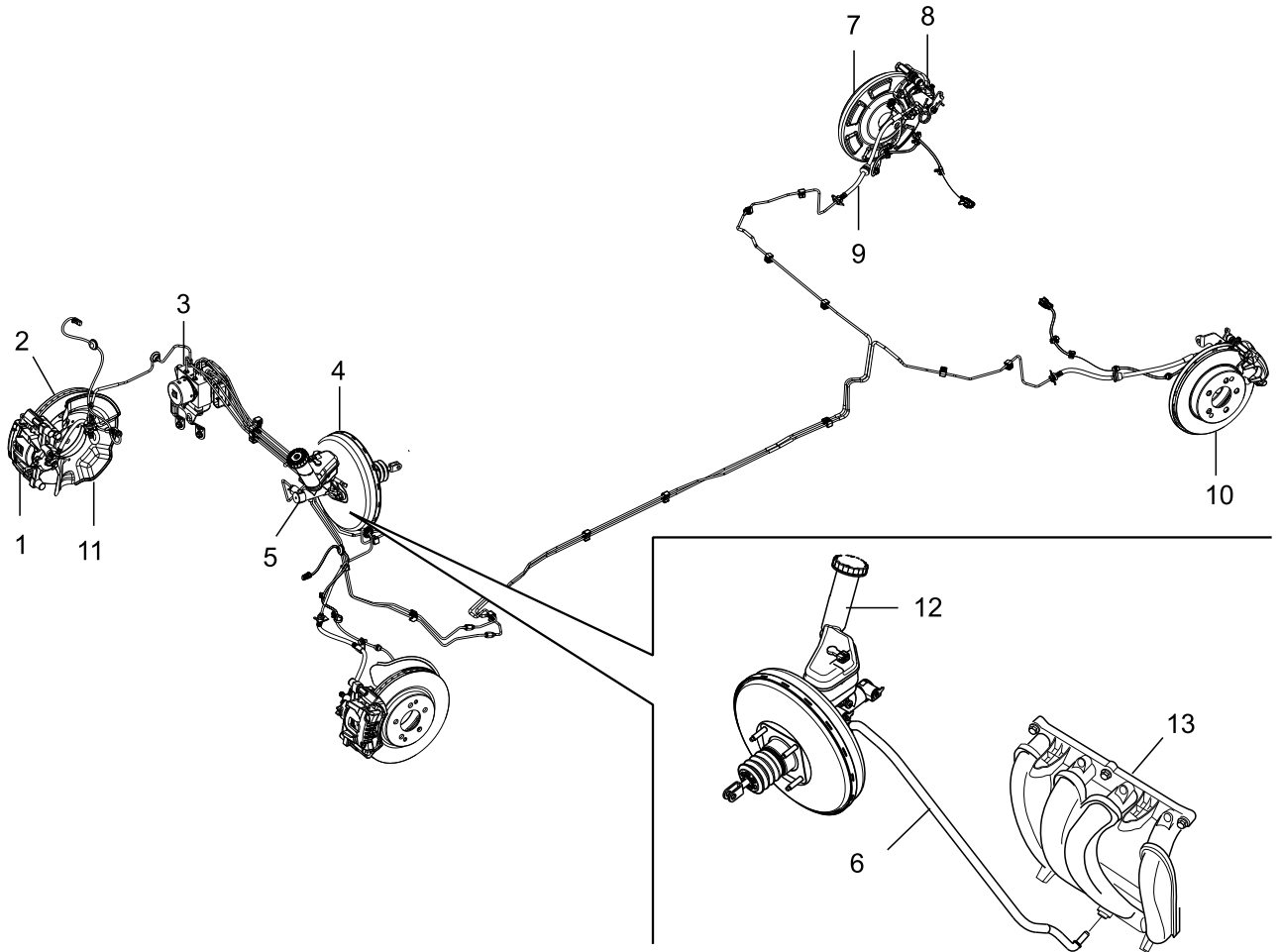
Parameter

| Model | |
|--|---|
| Front | Single Piston Floating Type Caliper Brake Construction of Ventilated Disc |
| Rear | Integrated Rear Brake Caliper Brake Construction of Solid Disc |
| Diameter of Brake Caliper Piston | |
| Front | 54 mm |
| Rear | 34mm |
| Diameter of Brake Disc | |
| Front | 280mm |
| Rear | 255mm |
| Minimum Thickness of Brake Disc | |
| New (Nominal Value) | 24mm |
| Limited Service Value | 21mm |
| Minimum Thickness of Rear Brake Disc | |
| New (Nominal Value) | 9mm |
| Limited Service Value | 7mm |
| Maximum Disc Runout (Equipped with Wheels) | 0.05 |
| Types of Brake Line | Diagonal Line, Double Lines, w/4 ABS Sensors |

Description and Operation

System Component Layout

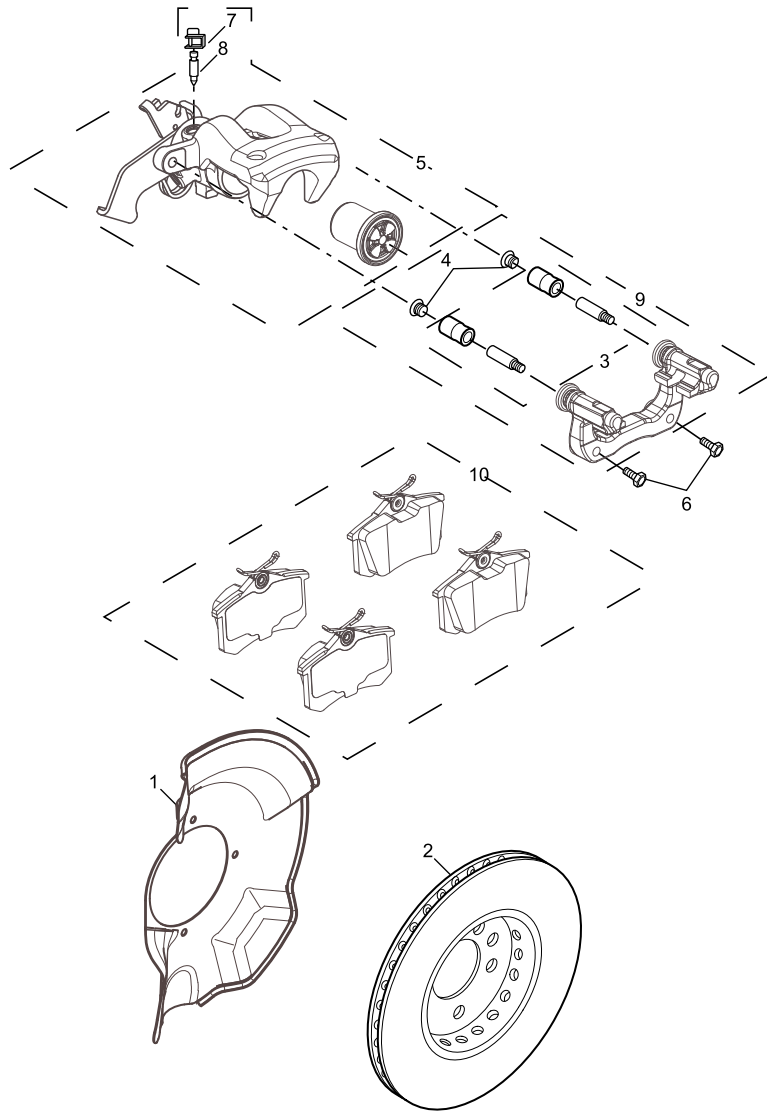
Brake Fluid Pressure System Component Layout



- 1. Front Brake Caliper Assembly
- 2. Front Brake Ventilated Hole Disc
- 3. ABS Adjuster
- 4. Front Disc
- 5. Brake Booster Assembly
- 6. Booster Vacuum Pipe and Check Valve
- 7. Rear Brake Caliper Assembly

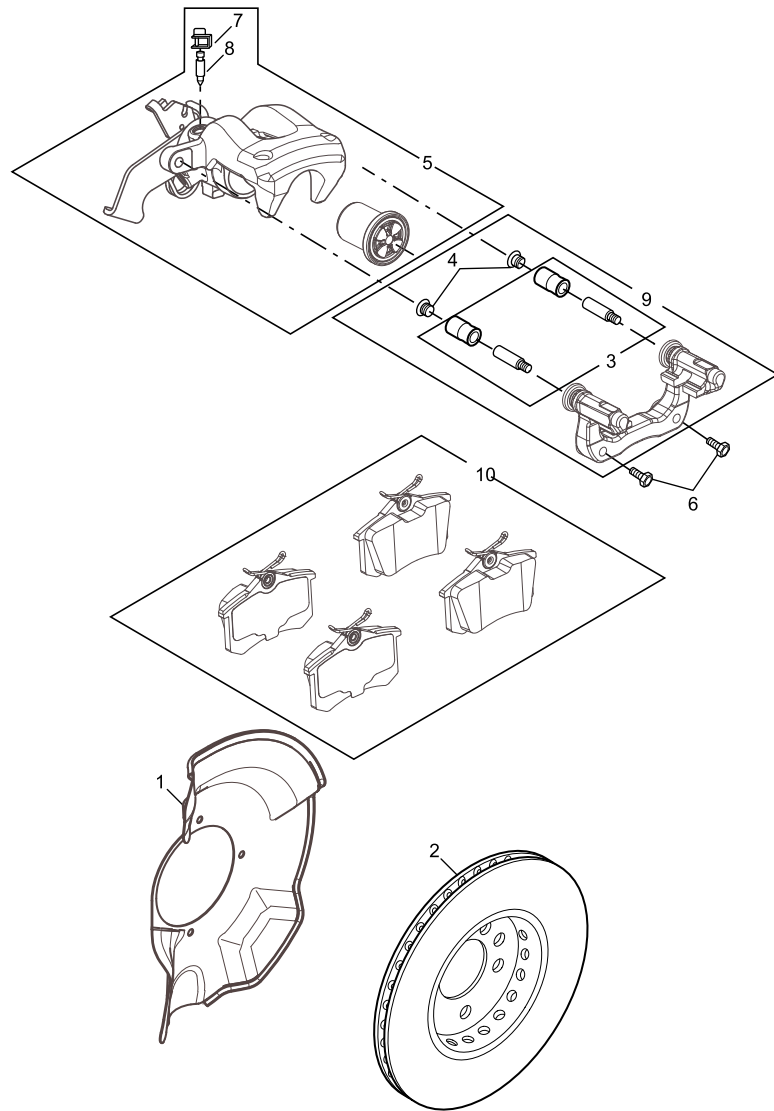
- 8. Rear Brake Disc Protector
- 9. Rear Brake Hose
- 10. Rear Brake Solid Disc
- 11. Front Brake Disc Protector
- 12. Brake Reservoir
- 13. Intake Manifold

Front Brake Caliper Exploded View



- | | |
|--|---|
| 1. Front Brake Disc Protector | 7. Bleed Screw |
| 2. Front Brake Ventilated Hole Disc | 8. Small Bleed Screw Cap |
| 3. Guide Pin Trim Cover | 9. Brake Caliper Guide Bracket |
| 4. Front Friction Lining Set | 10. Spring Washer - Front Brake Mounting Bolt |
| 5. Front Brake Caliper Housing Assembly | 11. Brake Guide Pin |
| 6. Bolt - Front Brake Caliper to Universal Joint | |

Rear Brake Caliper Exploded View



- | | |
|--|---|
| 1. Rear Brake Disc Protector | 6. Bolt-Rear Brake Caliper to Universal Joint |
| 2. Rear Brake Solid Disc | 7. Small Bleed Screw Cap |
| 3. Brake Guide Pin | 8. Bleed Screw |
| 4. Brake Guide Pin Pad | 9. Brake Caliper Guide Bracket |
| 5. Rear Brake Caliper Housing Assembly | 10. Brake Pad Set |

Description

Brake Pedal and Stop Lamp Switch

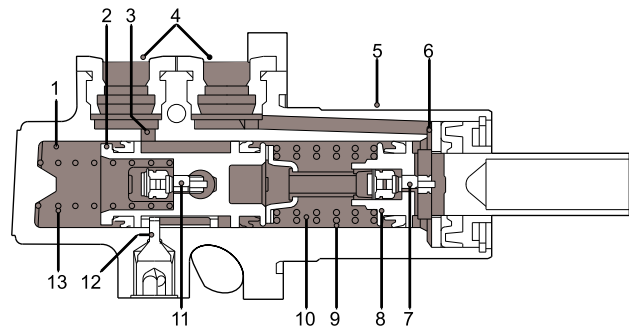
Brake pedal is fitted on rotor shaft which located on brake pedal mounting bracket of the dash panel, and the brake booster input lever is connected to the brake pedal with the lever pin and clevis clip. The brake booster input lever on the top of brake pedal controls the Hall-effect stop lamp switch which is on the brake pedal mounting bracket. The stop lamp switch provides two kinds of brake pedal status output: One is connected to **ABS ECU**; The second is connected to cruise control system (if equipped), automatic transmission **ECU** and the internal lock is used for automatic transmission shifting. **ECU**. The stop lamp switch contains a built-in sensor in the outer mounting spool. To ensure the correct fitting direction of the built-in sensor, the built-in sensor is fitted in mounting spool in a key-connected way; The mounting spool is also fitted on the brake pedal mounting bracket in a key-connected way; The built-in sensor stays in the right position in the spool due to the serration interacting between the mounting spool and the sensor. When the brake is released, the top of the brake pedal is against the end of the sensor; when the brake pedal is pressed, the top of the brake pedal is far from the sensor, and cause the output voltage of the sensor to change. If the brake switch is invalid, at least one of the following conditions may occur: one is that the cruise is invalid, and the other is that the stop lamp does not illuminate.

Vacuum Booster Assembly

When the brake is applied, the vacuum booster provides the assist force to decrease the required pedal force with braking. If the vacuum booster assembly is invalid, the hydraulic pressure system is still provided with the function of braking, but it needs a larger brake pedal force due to the lack of vacuum boost. Connect the vacuum booster assembly to the dash panel with 4 stud bolts. Connect the brake master cylinder assembly to the 2 retaining bolts of the front end of vacuum booster assembly. The vacuum booster assembly consists of round housing with 2-layer diaphragm, centre plate, control valve assembly, input push rod, output push rod and filter. The input push rod is connected to the brake pedal, and the output push rod is located inside the main piston of the brake master cylinder. The rubber gaiter is fitted at the rear housing extending area from the control valve on the control valve assembly. The hole of the front housing is connected to the vacuum tube with the check valve from the engine. The control valve assembly consists of valve body with the vacuum valve, piston, vacuum valve spring and input push rod spring. There are vacuum holes on the vacuum valve body. The piston controls the air inlet hole between the vacuum valve and piston. The reaction disc and proportioning disc separate the piston from the output push rod. The guide in the front of the valve body is fitted on the front diaphragm, and supports

in the bushing of the centre plate. There is a return spring on the guide opening end. The double-deck diaphragm and the centre plate divide the inner space of the round housing into 4 sealed chambers. Connect the chambers in front of the diaphragm together through the retaining passage of control valve assembly. Connect the chambers in the back of the diaphragm together through the inner of the secondary diaphragm of the retaining bolt.

Brake Master Cylinder Assembly



S402001

1. Secondary Pressure Chamber
2. Secondary Piston
3. Secondary Inlet
4. Brake Reservoir Interface
5. Brake Master Cylinder
6. Main Inlet
7. Main Centre Valve
8. Main piston
9. Main Spring
10. Main Pressure Chamber
11. Secondary Centre Valve
12. Valve Pin
13. Secondary Spring

When the brake pedal is pressed, the brake master cylinder assembly generates hydraulic pressure to operate the brakes. The assembly is fitted in front of the vacuum booster assembly, containing a pump body, and two pistons are fitted in the front and rear of the pump body. The rear piston generates brake pressure for the main circuit, and the front piston generates brake pressure for the secondary circuit. The brake reservoir is fitted at the top of the master cylinder. The interior of the reservoir is divided to provide fluid for each brake circuit independently, so it can avoid a case that neither of the main and secondary brake circuits can operate due to brake fluid leakage in one place. If one of the brake circuits has malfunction, the remaining brake circuits still operate effectively, but the brake pedal trips and the brake distance of

the entire vehicle will increase. If the brake fluid level in the reservoir is too low, the brake fluid level switch turns on to cut off the circuit between **ABS** adjuster and instrument panel and illuminate the brake warning light. The brake fluid level switch contains a spring plate switch which is located in the plastic gaiter securing on lower side of the reservoir. There is a permanent magnet on a float inside the reservoir. When the brake fluid level is in a proper height, this magnet makes the brake fluid level switch remain closed. When the height of brake fluid level is too low, the float subsides, and causes the spring plate switch to open.

Front Brakes

Each of the front brakes consists of a single piston, coast brake caliper assembly and a brake disc with ventilator fitted on the

hub. There is a protector inside the brake disc. On the right brake, a brake pad wear sensor is connected to the inside of the brake pad, and it is connected with rear brake pad wear sensor in series by the wire. The connector of the sensor connecting lead is located on the inner splash shield of the engine bay. When the hydraulic pressure is transmitted to the brake caliper, the piston extends outward, forcing the inner brake pad to lean against the brake disc. When the brake caliper housing is subject to the reactive force, slides along the guide pin and makes the outer brake pad contact the brake disc. If the brake pad is excessive worn, the wear sensor connecting lead will turn the circuit off by the brake pad wear sensor due to the worn right brake disc, causing the brake pad wear warning light on the instrument panel to illuminate.

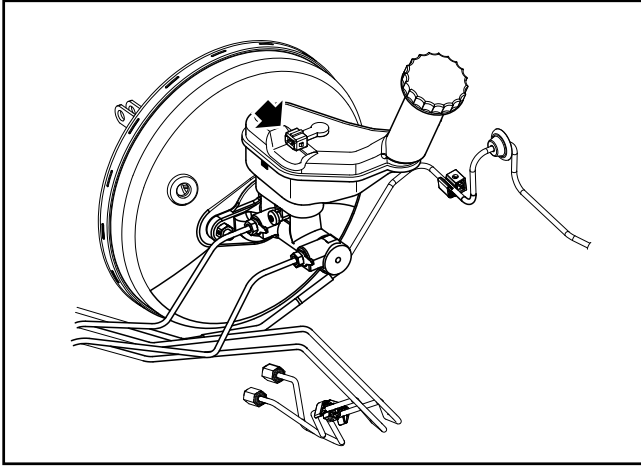
Service Procedures

Brake Fluid Level Indication Switch

Caution: The brake fluid can damage the painted surface. If the fluid spills, immediately remove the fluid and clean this area with water.

Removal

1. Disconnect the connector from the brake fluid level switch.
2. Loosen the snap fit securing the brake fluid level switch to brake reservoir, and remove the switch.



Caution: The brake fluid can damage the painted surface. If the fluid spills, immediately remove the fluid and clean this area with water.

Refit

1. Fit the brake fluid level switch to the brake reservoir, and secure it with the snap fit.
2. Connect the connector to the brake fluid level switch.

Brake Master Cylinder and Reservoir Assembly

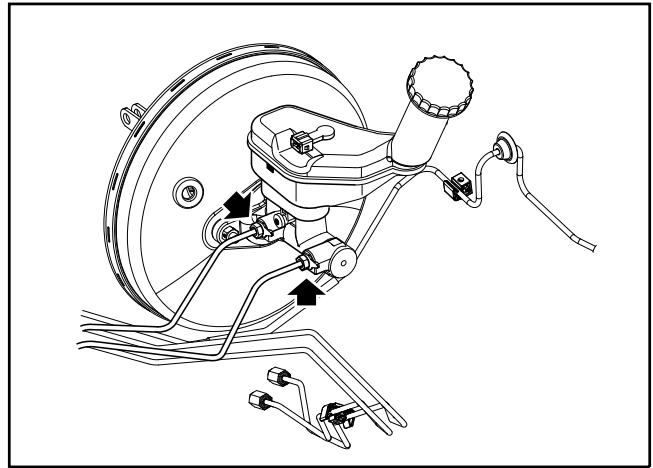
Caution: The brake fluid can damage the painted surface. If the fluid spills, immediately remove the fluid and clean this area with water.

Removal

1. Place the cloth under the **ABS** adjuster to absorb the overflowing fluid.

Caution: The brake fluid can damage the painted surface. If the fluid spills, immediately remove the fluid and clean this area with water.

2. Disconnect the connector from the brake fluid level switch.
3. Loosen the 2 brake hard tubes from the brake master cylinder.



4. Loosen the clip securing the connector to the battery box support, and loosen the connector.
5. Loosen the engine bay wire harness from the battery box bracket, and disconnect the connector main wire.
6. Remove the 2 nuts and gasket securing the master cylinder to the vacuum booster, and discard the nuts.
7. Remove the master cylinder and the reservoir assembly.

Refit

1. Position the brake master cylinder onto the vacuum booster, and secure it with the 2 new nuts. Tighten the nuts to **21-29 Nm**.
2. Clean the brake hard tube joint.
3. Fit the brake hard tube to the brake master cylinder, and tighten to **20-24 Nm**.
4. Position the engine bay wire harness connector to battery box bracket and connect it to the main wire. Secure the wire harness connector to the bracket.
5. Position **ECM** wire harness and connect the connector.
6. Connect the connector on the brake fluid level switch.
7. Drain the brake system.

 **Drain Brake System**

Vacuum Booster Assembly

Removal

1. Remove the battery box cover.

 **Battery Box Cover**

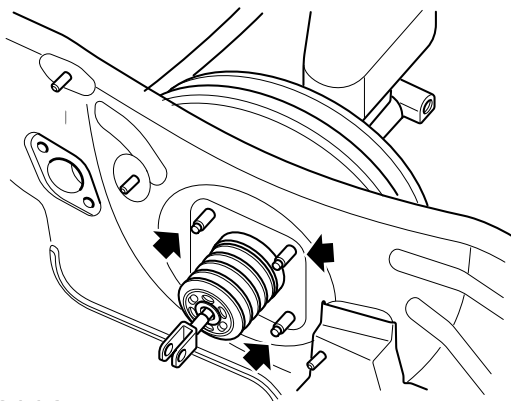
2. Disconnect the connector from the brake fluid level switch.
3. Place the cloth under the reservoir to absorb the overflowing fluid.

Caution: *The brake fluid can damage the painted surface. If the fluid spills, immediately remove the fluid and clean this area with water.*

4. Loosen the 2 brake hard tubes from the brake master cylinder.

Caution: *Before disconnecting or removing brake lines, ensure that the centre area around lines and connections are clean. Plug opened connection to prevent contamination entering.*

5. Disconnect the vacuum pipe from the vacuum booster.
6. Remove the driver side lower cover plate assembly.
7. Remove the spring plate nut and pin lever securing the vacuum booster to brake pedal.
8. Remove 4 nuts securing the vacuum booster to dash lower panel, and remove the vacuum booster and brake master cylinder assembly.



S402002

9. Remove the 2 nuts and gaskets securing the master cylinder to the vacuum booster, and discard the nuts.
10. Remove the vacuum booster assembly.

Refit

1. Position the brake master cylinder onto the vacuum booster, and secure it with the 2 new nuts. Tighten the nuts to **21-29 Nm**.
2. Clean the mating surface of the vacuum booster and body.
3. Fit vacuum booster assembly and secure it to the body dash panel with the nuts. Tighten the nuts to **8-18 Nm**.
4. Position the vacuum booster push rod to the brake

pedal and secure it with pin lever and spring plate nuts.

5. Fit the driver side lower cover plate assembly.
6. Connect the vacuum pipe to the vacuum booster.
7. Clean the brake hard tube joint.
8. Fit the brake hard tube to the brake master cylinder, and tighten to **20-24 Nm**.
9. Connect the connector to the brake fluid level switch.
10. Drain the brake system.

 **Drain Brake System**

11. Fit the battery box cover.

 **Battery Box Cover**

Break Pedal

Removal

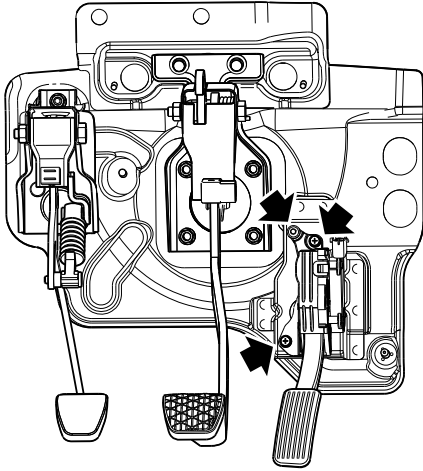
1. Disconnect the battery earth lead.
2. Remove the steering column lower cover plate.

Steering Column Lower Cover Plate

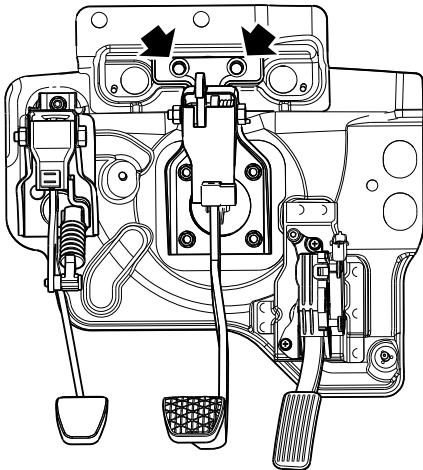
3. Remove the stop lamp assembly.

Stop Lamp Switch Assembly

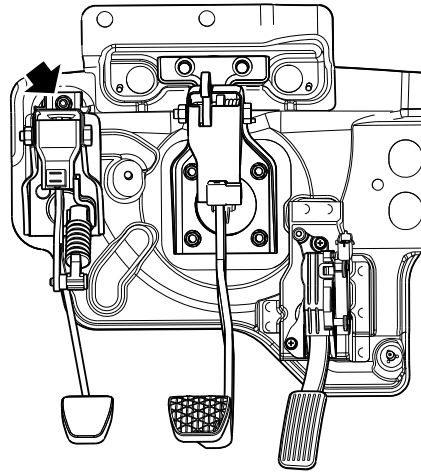
4. Loosen a stud and 2 bolts securing the accelerator pedal to the dash panel.



5. Remove the accelerator pedal.
6. Loosen the nuts securing the vacuum booster push rod to the brake pedal.
7. Loosen the 2 bolts securing the brake pedal to the dash panel.
8. Remove the brake pedal.



9. Loosen the pin and the snap fit securing the clutch pedal to the clutch master cylinder.



10. Loosen the 2 nuts securing the clutch pedal to the dash panel.
11. Remove the clutch pedal.

Refit

1. Pass the clutch pedal bolt through the dash panel so that it fits the clutch master cylinder bore.
2. Fit the nut to the clutch pedal stud, and tighten it to **8-18 Nm**.
3. Fit the clutch pedal arm onto the clutch push rod clevis, insert the pin, and fit the snap fit at last.
4. Adjust the clutch master cylinder push rod clevis to place the clutch pedal in the proper position.
5. Pass the vacuum booster stud through the dash panel so that it fits the brake pedal bore.
6. Tighten the nuts in the order of bottom RH, bottom LH, and the two nuts in the middle to **8-18 Nm**.
7. Pass the brake pedal bolts through the dash panel, and tighten them to **8-18 Nm**.
8. Secure the accelerator pedal to the dash panel with 2 bolts and a stud, and tighten them to **4-8 Nm**.
9. Fit the stop lamp assembly.

Stop Lamp Switch Assembly

10. Fit the steering column lower cover plate.

Steering Column Lower Cover Plate

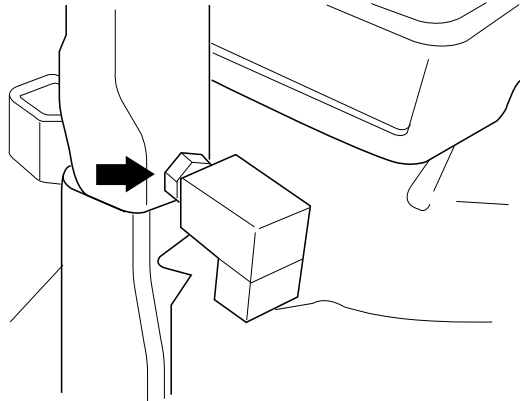
Stop Lamp Switch Assembly

Removal

1. Disconnect the battery earth lead.
2. Remove the steering column lower cover plate.

 **Steering Column Lower Cover Plate**

3. Loosen the set nuts of stop lamp switch, and detach the switch.



S402003

Refit

1. Connect the connector to brake switch.
2. Fit the stop lamp switch retaining bolts to the brake pedal, and tighten them to **8-12 Nm**.
3. Release the brake pedal, be sure to contact the brake switch with operation point on the brake pedal.
4. Fit steering pipe lower plate assembly.

 **Steering Column Lower Cover Plate**

5. Connect the battery earth lead.

Front Brake Caliper Housing Assembly

Removal

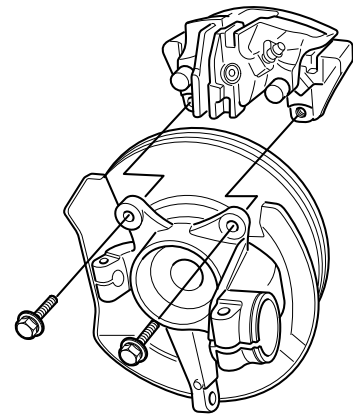
1. Raise the vehicle on a lift.
2. Remove the front wheel.

 **Wheel**

3. Remove the service bolt and gasket from the brake hose to brake caliper.
4. Disconnect the brake hose, block the brake caliper and brake hose opening to prevent the brake fluid from running off and being polluted.

Caution: Before disconnecting or removing brake lines, ensure that the centre area around lines and connections are clean. Plug opened connection to prevent contamination entering.

5. Remove the brake caliper mounting bolt from the steering knuckle, and then remove the brake caliper assembly.



S402004

Refit

1. Clean the brake components.

Warning: DO NOT clean the brake components with compressed air. Dust from friction materials are hazardous to your health, DO NOT inhale it by mistake.

2. Fit the brake caliper assembly with mounting bolt, and tighten the bolt to **90-110 Nm**.
3. Connect the brake hose, tighten the brake hose inlet union to the brake caliper bolt and gasket to **20-30 Nm**.
4. Drain the brake system.

 **Drain Brake System**

5. Fit the wheels.
6. Lower the vehicle.

 **Wheel**

Front Brake Pad

Removal

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

1. Raise the vehicle on a lift.
2. Remove the front wheel.

Wheel

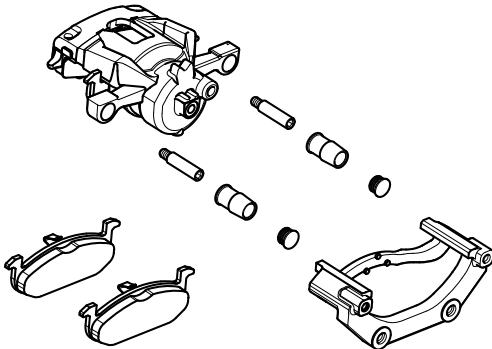
3. Remove the front brake caliper assembly.

Front Brake Caliper Assembly

4. Remove the 2 trim caps from the front brake caliper guide dust cover.
5. Remove the 2 front brake caliper guides from the front brake caliper housing.
6. Remove the front brake caliper housing assembly from the front brake caliper bracket.

Caution: DO NOT hang the brake caliper on brake hose.

7. Remove the front brake pad from the front brake caliper housing assembly.



S402005

Refit

1. Remove any dirt and corrosives from the front disc edge.
2. Clean the front brake caliper housing and the front brake caliper bracket. Check the front brake caliper and seal for damage.

Warning: DO NOT clean the brake components with compressed air. Dust from friction materials are hazardous to your health, DO NOT inhale it by mistake.

3. Hold the drain bottle, connect the drain hose to the draining screw, and loose the screws (each side).
4. press the front brake caliper piston into the front brake caliper housing, and tighten the draining screw again to **9-11 Nm**.
5. Disconnect the drain hose, and take away the drain bottle.

6. Secure the draining screw dust cover to the draining screw.
7. Fit the brake pad to the brake caliper housing assembly.
8. Use proper anti-sticking grease to lubricate the front brake guide.

Caution: If the brake pad warning light was illuminated before replacing brake pads, replace the brake pad wear sensor with a new one, otherwise, the warning light will still be illuminated.

9. Secure the front brake caliper housing to front brake caliper bracket and align it. Fit front brake caliper guide and tighten it.
10. Fit the trim cover cap to the front brake caliper guide dust cover.
11. Inspect/Add the brake reservoir.

Caution: Never reuse the brake fluid that has been bled from the brake system.

12. Fit the wheels.

Wheel

13. Lower the vehicle.
14. Press the brake pedal several times to fit the front brake pad.

Tip: The pedal trips may be longer than normal during the first brake application.

Front Disc

Removal

Caution: Brake discs must be replaced in pairs, unless the disc is just changed with a new one and the vehicle drive less than 1,500 miles.

1. Raise the vehicle on a lift.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

2. Remove the front wheel.



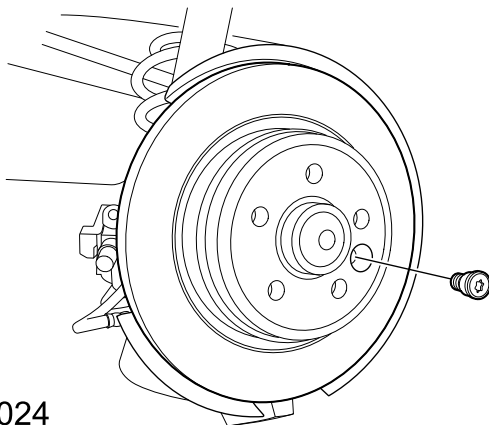
Wheel

3. Remove the front brake caliper assembly.



Front Brake Caliper Assembly

4. Remove the countersunk head screw securing the front disc to the front drive wheel flange.



S323024

5. Remove the front disc assembly.

Refit

1. Make sure the mating surface of the front disc and front drive wheel flange is clean.
2. Fit the front disc to the front drive wheel flange, and then fit the countersunk head screw and tighten it to **5-7 Nm**.
3. Inspect the runout of front disc.



Inspection of Thickness and Round Runout - Front Disc

4. Inspect the front brake pad, and replace it as necessary.
5. Fit the front brake caliper to front hub, then fit the bolt and tighten it to **85-105 Nm**.



Front Brake Caliper Assembly

6. Fit the wheels.



Wheel

7. Lower the vehicle.

Inspection of Thickness and Round Runout - Front Disc

Inspection

1. Raise the vehicle on a lift.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

2. Remove the front wheel.



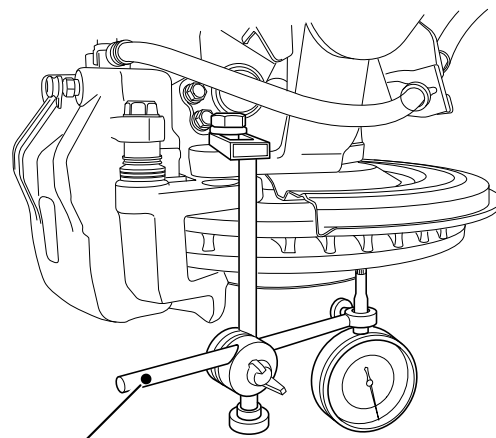
Wheel

3. Remove the front brake caliper assembly.



Front Brake Caliper Assembly

4. Using differential gauge/micrometer, measure the thickness of the front disc along 4 evenly distributed points on its surface, and the measuring points should be located at 10 mm away from its edge. The thickness of brake disc is at least 20.0 mm. If it exceeds the limits, the front disc must be replaced.



TCH00022

Caution: Brake discs must be replaced in pairs, unless the disc is just changed with a new one and the vehicle drive less than 1,500 miles.

5. Fit a dial test indicator (DTI), and secure it to the inside of the front hub with the bolt hole of the front brake caliper assembly.
6. Set the probe of DTI on the brake disc with 5 mm away from its edge.
7. Zero the DTI, turn the wheel in a complete circle to measure the runout of brake disc. The runout of brake disc is less than 0.05 mm.
8. If the runout of brake disc exceeds the limits:
 - Remove the countersunk head screw securing the front disc to the front hub and then remove the front disc.
 - Make sure the mating surface from the front disc to front hub flange is clean.
 - Fit the front disc to the front hub, then fit countersunk head screw and tighten to **5-7 Nm**.

- Recheck the runout of the brake disc according to the previous detailed procedure.
 - If the runout still exceeds the limits, replace the front disc or front hub.
9. Remove DTI from inside of front hub and TCH00022.
 10. Fit the front brake caliper assembly to the front hub, then fit the bolt and tighten it to **85-105 Nm**.

Front Brake Caliper Assembly

11. Fit the wheels.

Wheel

12. Press the brake pedal several times to adjust the front brake pad.
13. Lower the vehicle.

Rear Disc

Removal

Caution: Brake discs must be replaced in pairs, unless the disc is just changed with a new one and the vehicle drive less than 1,500 miles.

1. Raise the vehicle on a lift.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

2. Remove the rear wheel.

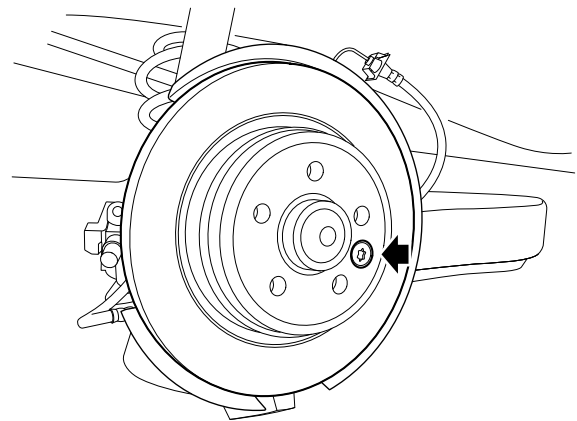
Wheel

3. Remove the rear brake caliper assembly.

Rear Brake Caliper Assembly

Caution: DO NOT hang the brake caliper on brake hose.

4. Remove the countersunk head screw securing the rear brake disc.



S402007

5. Remove the rear disc assembly.

Refit

1. Make sure the mating surface of the rear disc and rear drive wheel flange is clean.
2. Fit the rear disc to the rear wheel drive flange, then fit the countersunk head screw and tighten it to **5-7 Nm**.
3. Inspect the runout of rear disc.

Inspection of Thickness and Round Runout – Rear Disc

4. Inspect the rear brake pad, and replace it as necessary.
5. Fit the rear brake caliper assembly to the rear hub, then fit the bolt and tighten it to **85-105 Nm**.

Rear Brake Caliper Assembly

6. Fit the wheels.

Wheel

7. Lower the vehicle.

Inspection of Thickness and Round Runout - Rear Disc

Inspection

1. Raise the vehicle on a lift.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

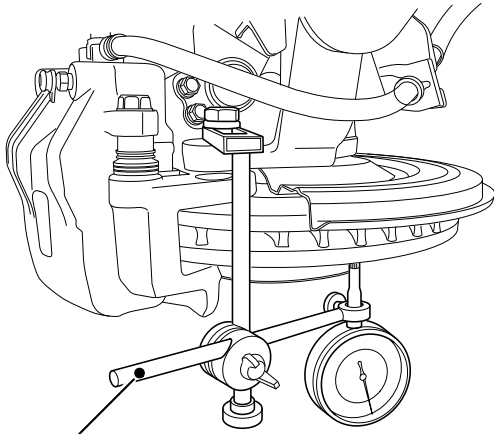
2. Remove the rear wheel.

Wheel

3. Remove the rear brake caliper assembly.

Rear Brake Caliper Assembly

4. Using differential gauge/micrometer, measure the thickness of the front disc along 4 evenly distributed points on its surface, and the measuring points should be located at 10 mm away from its edge. The thickness of brake disc is at least 20.0 mm. If it exceeds the limits, the front disc must be replaced.



TCH00022

Caution: Brake discs must be replaced in pairs, unless the disc is just changed with a new one and the vehicle drive less than 1,500 miles.

5. Fit a dial test indicator (DTI), and secure it to the inside of the rear hub with the bolt hole of the rear brake caliper assembly.
6. Set the probe of DTI on the rear disc with 10 mm away from its edge.
7. Zero the DTI, turn the wheel in a complete circle to measure the runout of brake disc. The runout of brake disc is less than 0.05 mm.
8. If the runout of brake disc exceeds the limits:
 - Remove countersunk head screw securing the rear disc to front hub and remove the rear disc.
 - Be sure to clean the mating surface from the rear disc to rear wheel flange.
 - Fit the rear disc to the rear hub, then fit the countersunk head screw and tighten it to **5-7 Nm**.
 - Fit the wheels

- Recheck the runout of the rear brake disc according to the previous detailed procedure.
 - If the runout still exceeds the limits, replace the rear disc or rear hub.
9. Remove DTI from inside of rear hub and TCH00022.
 10. Fit the rear brake caliper assembly to the rear hub, then fit the bolt and tighten it to **85-105 Nm**.

Rear Brake Caliper Assembly

11. Fit the wheels.

Wheel

12. Press the brake pedal several times to adjust the rear brake pad.
13. Lower the vehicle.

Rear Brake Caliper Housing Assembly

Removal

1. Raise the vehicle on a lift.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

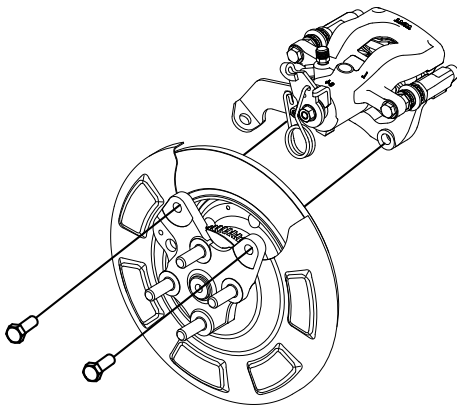
2. Remove the rear wheel.

Wheel

3. Remove the service bolt and gasket from the brake hose to brake caliper.
4. Disconnect the brake hose, block the brake caliper and brake hose opening to prevent the brake fluid from running off and being polluted.

Caution: Before disconnecting or removing brake lines, ensure that the centre area around lines and connections are clean. Plug opened connection to prevent contamination entering.

5. Remove the brake caliper mounting bolt from the steering knuckle, and then remove the brake caliper assembly.



S420040

Refit

1. Clean the brake components.

Warning: DO NOT clean the brake components with compressed air. Dust from friction materials are hazardous to your health, DO NOT inhale it by mistake.

2. Fit the brake caliper assembly with mounting bolt, and tighten the bolt to **85-105 Nm**.
3. Connect the brake hose, tighten the brake hose inlet union to the brake caliper bolt and gasket to **20-30 Nm**.
4. Drain the brake system.

Drain Brake System

5. Fit the wheels.

Wheel

6. Lower the vehicle.

Rear Brake Pad

Removal

Warning: Brake pads must be replaced with axle in pairs, otherwise brake efficiency may be impaired.

1. Raise the vehicle on a lift.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

2. Remove the rear wheel.

Wheel

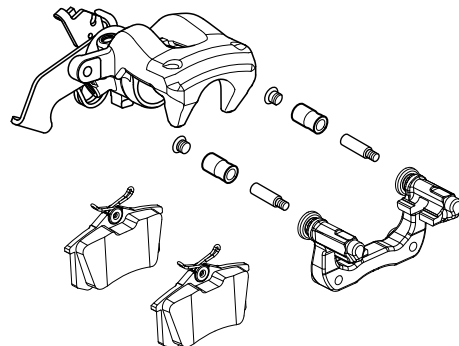
3. Remove the rear brake caliper assembly.

Rear Brake Caliper Assembly

4. Unscrew the rear brake caliper guide mounting bolt.
5. Remove the 2 front brake caliper guides from the rear brake caliper housing.
6. Remove the rear brake caliper housing assembly from the rear brake caliper bracket.

Caution: DO NOT hang the brake caliper on brake hose.

7. Remove the rear brake pad from the rear brake caliper housing assembly.

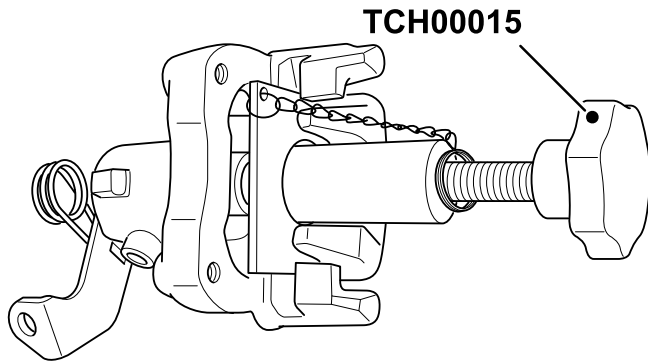


Refit

1. Remove any dirt and corrosives from the rear disc edge.
2. Clean the rear brake caliper housing and the rear brake caliper bracket. Check the front brake caliper and seal for damage.

Warning: DO NOT clean the brake components with compressed air. Dust from friction materials are hazardous to your health, DO NOT inhale it by mistake.

3. Hold the drain bottle, connect the drain hose to the draining screw, and loose the screws (each side).
4. Using the special tool TCH00015, press the rear brake caliper piston into the rear brake caliper housing, and tighten the draining screw again to **9-11 Nm**.



5. Disconnect the drain hose, and take away the drain bottle.
6. Secure the draining screw dust cover to the draining screw.
7. Fit the brake pad to the brake caliper housing assembly.
8. Use proper anti-sticking grease to lubricate the rear brake guide.
9. Secure the rear brake caliper housing to rear brake caliper bracket and align it. Fit rear brake caliper guide and tighten it.

Caution: If the brake pad warning light was illuminated before replacing brake pads, replace the brake pad wear sensor with a new one, otherwise, the warning light will still be illuminated.

10. Fit the trim cover cap to the rear brake caliper guide dust cover.
11. Inspect/Add the brake reservoir.
12. Fit the wheels.

 **Wheel**

13. Lower the vehicle.
14. Press the brake pedal several times to fit the rear brake pad.

Tip: The pedal trips may be longer than normal during the first brake application.

Drain Brake System

Drain

Warning: DO NOT allow the brake fluid to contact your eyes or skin.

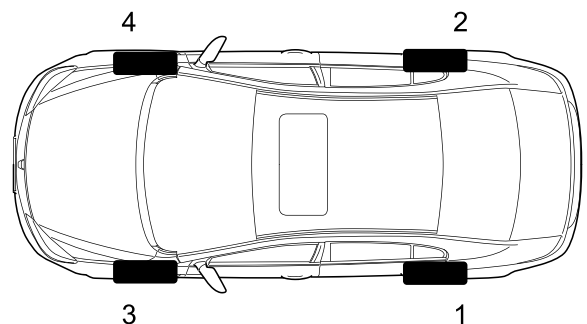
Caution: Never reuse the brake fluid that has been bled from the brake system.

The following steps include the drain methods for the entire system, but if the main circuit or sub circuit becomes an independent circuit, only operate the required drain circuit. Only when the brake hard tube or the brake hose is disconnected, and a small amount of fluid loses, it is allowed to drain the hydraulic pressure system.

1. Add the brake reservoir to MAX mark position.

Caution: Ensure the level of new brake fluid in the brake reservoir is between the MIN and MAX throughout the whole bleed procedures.

2. Raise the vehicle on a lift.
3. Remove the drain screw dust cover from the rear brake caliper RH (for LHD), and fit the hose to drain screw. Submerge the free end of the hose into a container full of new brake fluid.
4. Apply the brake to brake pedal several times, and then apply a steady pressure.
5. Loosen the drain screw to separate the brake fluid and air. Allow the pedal to return without any external force.
6. Smoothly press the brake pedal to maximum stroke, and allow it to return without any external force. Repeat the operation several times until the brake fluid flows into the container without any air, and secure the brake pedal to maximum stroke, then tighten the drain screw to **9-11 Nm**.
 - LHD Mode: Rear LH; Front RH; Front LH.
 - RHD Mode: Rear RH; Front LH; Front RH.
7. Remove the hose from the drain screw, and fit the drain screw dust cover.



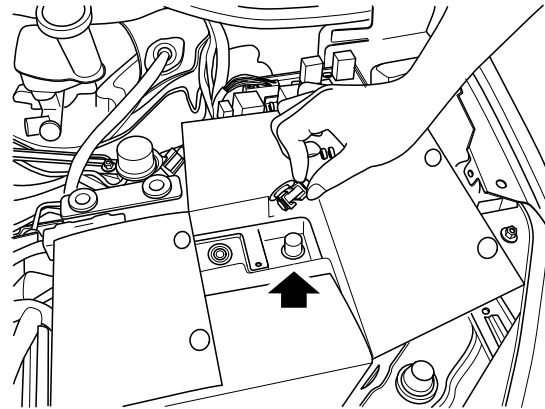
8. Repeat drain the other 3 brake calipers in the following order.
 - LHD Mode: Rear LH; Front RH; Front LH.
 - RHD Mode: Rear RH; Front LH; Front RH.

Warning: Brake efficiency may be seriously impaired, if draining is in incorrect sequence.

9. Lower the vehicle.
10. Add the brake reservoir to MAX mark line.
11. Apply the brakes and check for leakage.
12. Test the vehicle on the road. When the brake operates, check the minimum stroke of brake pedal.

Electronic Vacuum Pump - Aftermarket Removal

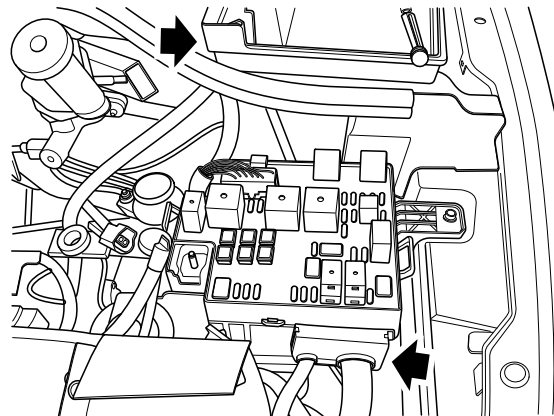
1. Disconnect the battery negative terminal.



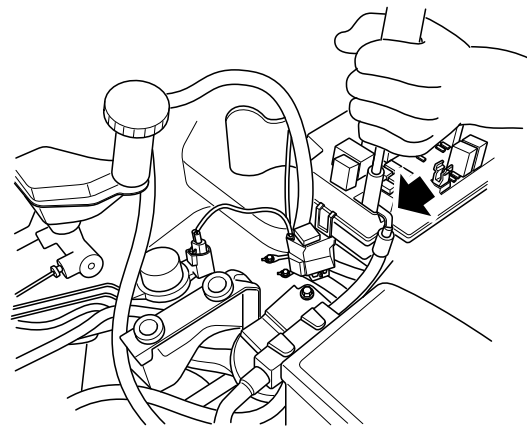
2. Remove the air cleaner assembly.

Air Cleaner Assembly Removal

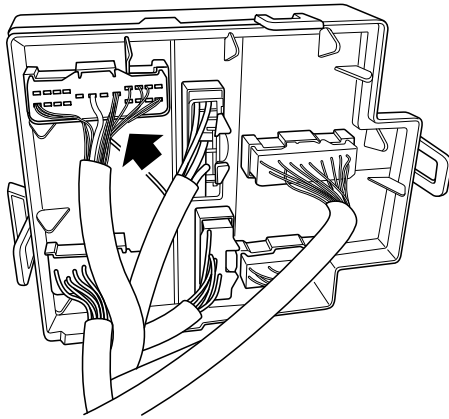
3. Remove the upper cover and waterproof plate on the engine compartment fuse box.



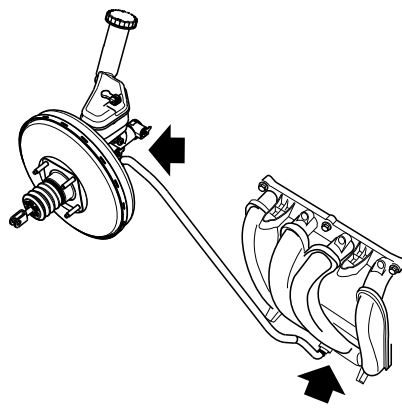
4. Disconnect the engine compartment fuse box positive cable.



5. Remove the fuse box body, and the connector indicated by the arrow in the illustration below is: BD054.

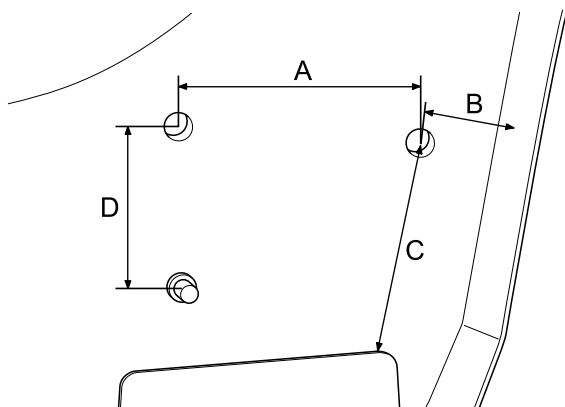


6. Remove the vacuum hose assembly.

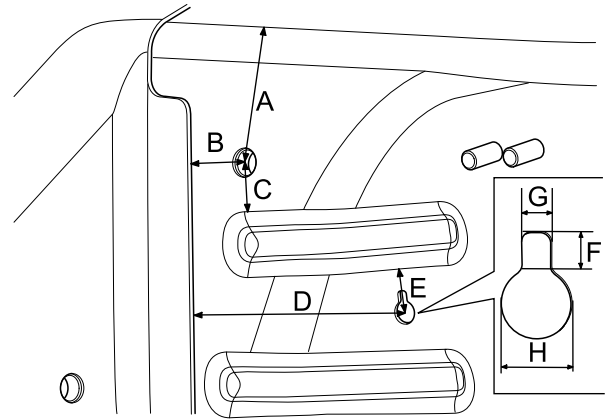


Refit

1. Drill four holes in the front longitudinal member LH with a drill using the dimension in the illustration below. Three of the holes are used to fit the electronic vacuum pump support and their sizes are M11; One of them is used to fit the connector and the size is $\phi 7$.



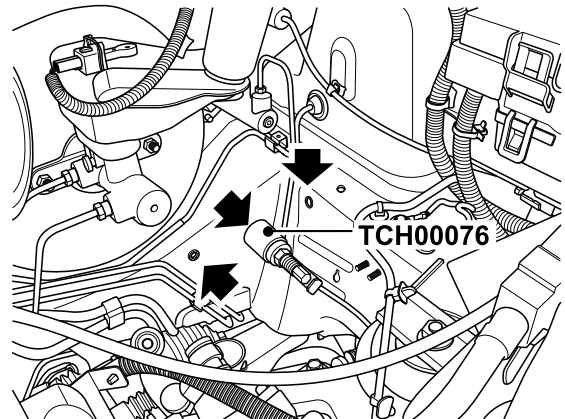
A = 73 mm, B = 26 mm, C = 63 mm, D = 48 mm



A = 43 mm, B = 21 mm, C = 15 mm, D = 75 mm, E = 14 mm, F = 3.5 mm, G = 3 mm, H = 7 mm

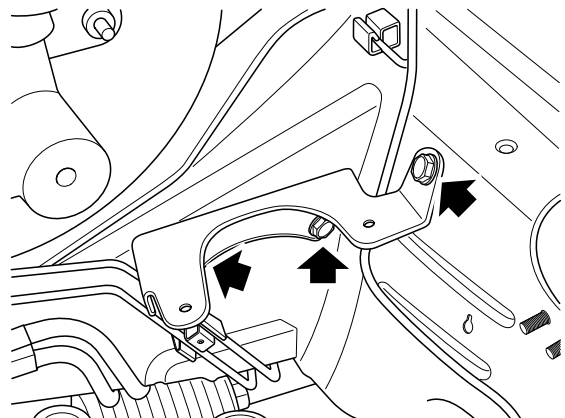
Caution: When drilling, DO NOT let the chips drop into the hole, apply a coat of paint on the mounting hole to protect paint.

2. Using the special tool TCH00076, fit the 3 riveted nuts into 3 holes.



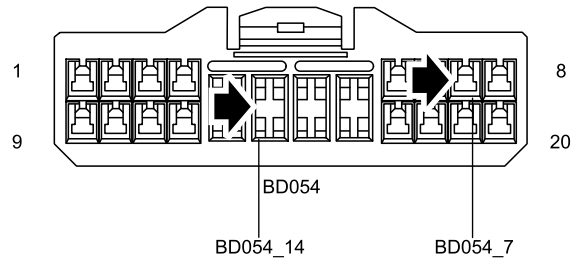
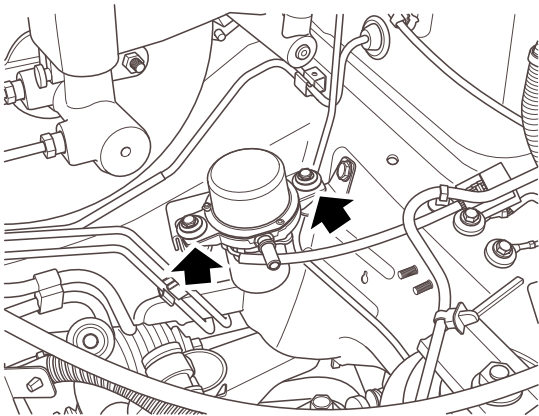
Tip: Protect the contact surfaces between EVP bracket and the body with paint.

3. Tighten the 3 bolts securing the electronic vacuum pump bracket to the longitudinal member to 19-25 Nm.

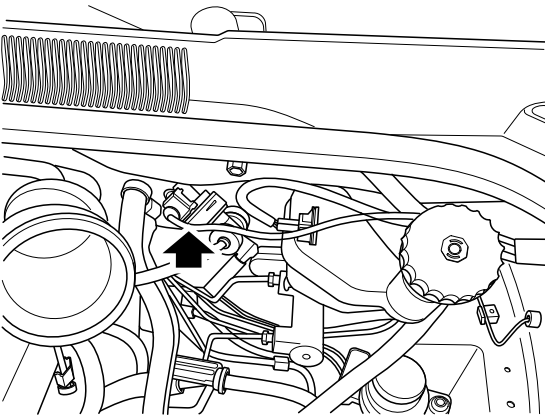


4. Tighten the 2 bolts securing the electronic vacuum

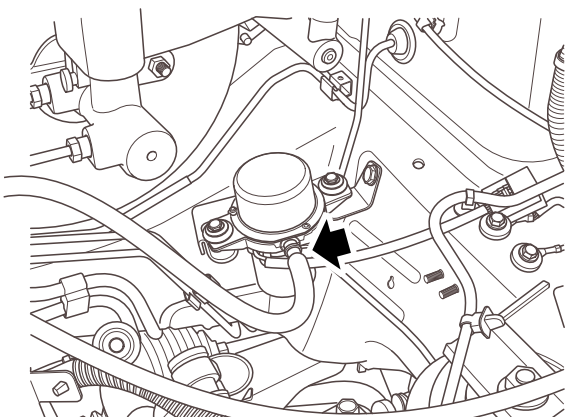
pump to the bracket to **8.8 Nm**.



5. Connect the vacuum switch connector on the electronic vacuum pump wire harness to the vacuum switch.



6. Connect the vacuum hose assembly to the electronic vacuum pump.

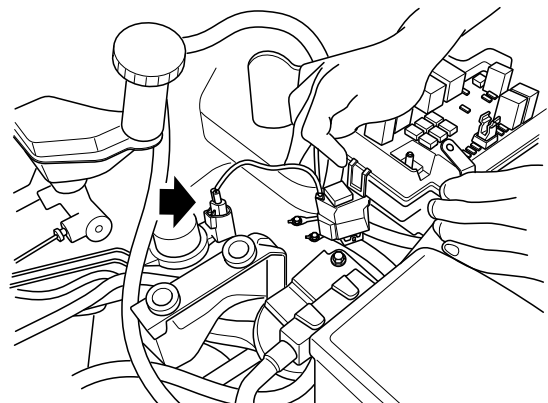


7. Connect the vacuum hose to the vacuum booster and intake manifold.
8. Insert the 2 terminals of the electronic vacuum pump wire harness into PIN7 PIN14 of the connector BD054: the red terminal (Wire diameter: 1.25) is inserted into PIN14, and the pink terminal (Wire diameter: 0.85) is inserted into PIN7.

| BD054 | | | |
|-------|-----------------|-----|-----------------------|
| Cav | Col | Cav | Col |
| 1 | White | 11 | White/Red |
| 2 | Dark Blue/White | 12 | - |
| 3 | Black/White | 13 | Purple |
| 4 | Orange | 14 | Red |
| 5 | - | 15 | Orange |
| 6 | - | 16 | - |
| 7 | Pink | 17 | - |
| 8 | White/Purple | 18 | - |
| 9 | Light Blue | 19 | Pink |
| 10 | Dark Blue/Gray | 20 | Red/Yellow/Dark Green |

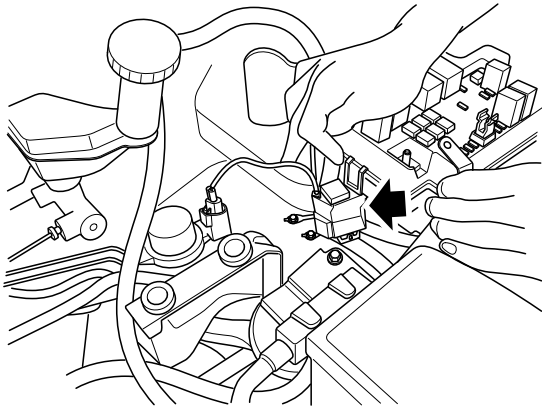
Tip: Before inserting the PIN, release the white buckle on the connector BD054.

9. Connect the vacuum pump connector of the electronic vacuum pump wire harness to the connector of the vacuum pump.

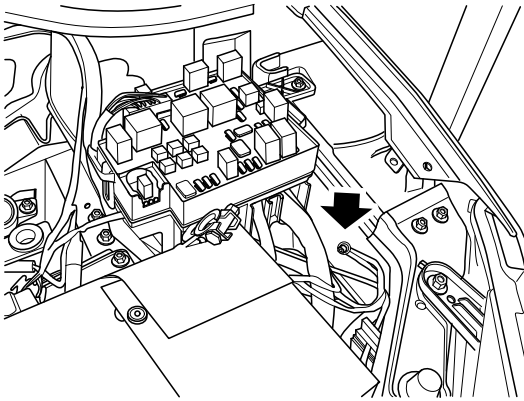


10. Secure the vacuum pump relay on the electronic vacuum pump wire harness to the body main wire with

bands.



11. Connect the ground strip connector of the electronic vacuum pump wire harness to the position as shown in the illustration.



12. Add brake fluid to the reservoir to the MAX mark line.
13. Fit the air cleaner assembly.

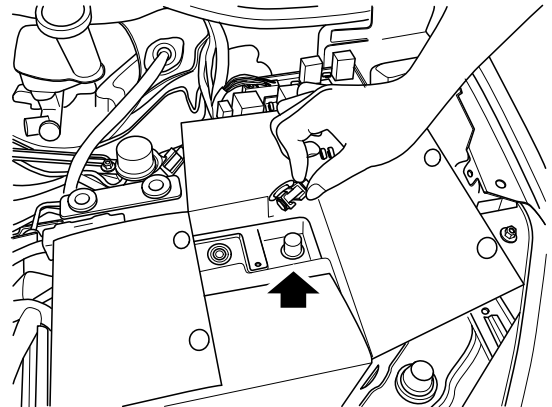
Hand icon **Air Cleaner Assembly Refit**

14. Connect the battery negative terminal.

Electronic Vacuum Pump

Removal

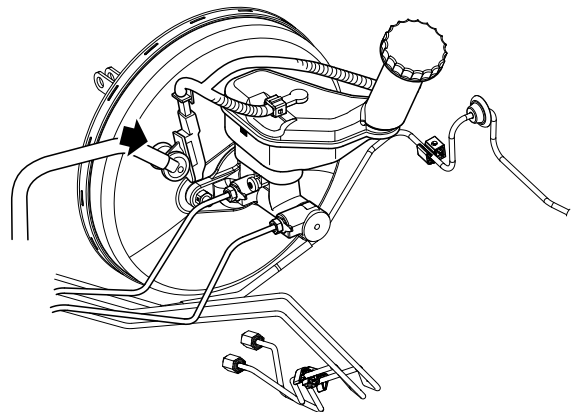
1. Disconnect the battery negative terminal.



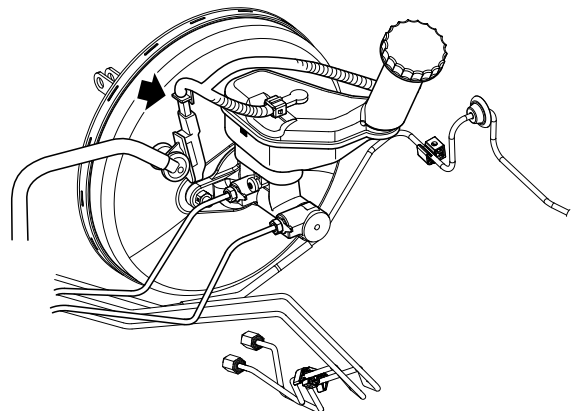
2. Remove the air cleaner assembly.

Hand icon **Air Cleaner Assembly Removal**

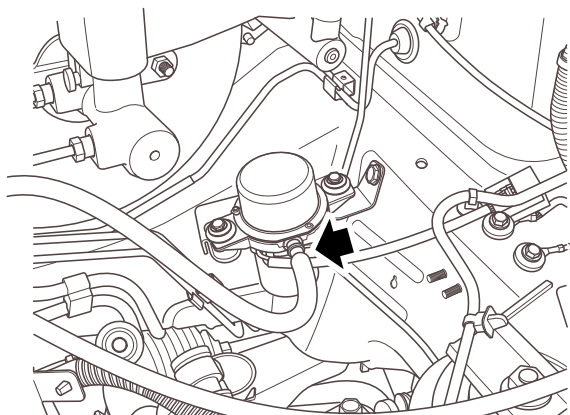
3. Loosen the vacuum hose connected to the vacuum booster.



4. Loosen the wire harness connected to the vacuum sensor.



5. Loosen the vacuum hose connected to the electronic vacuum pump.

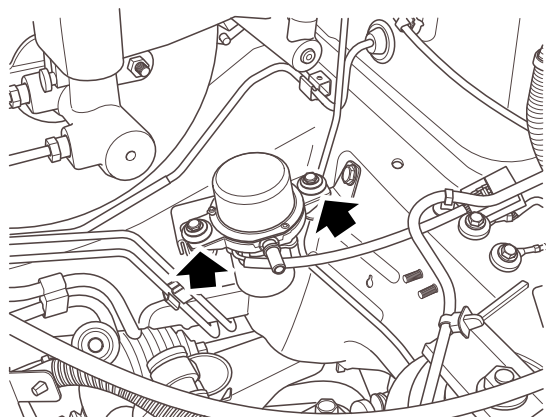


5. Connect the vacuum hose assembly to the electronic vacuum pump.
6. Fit the air cleaner assembly.

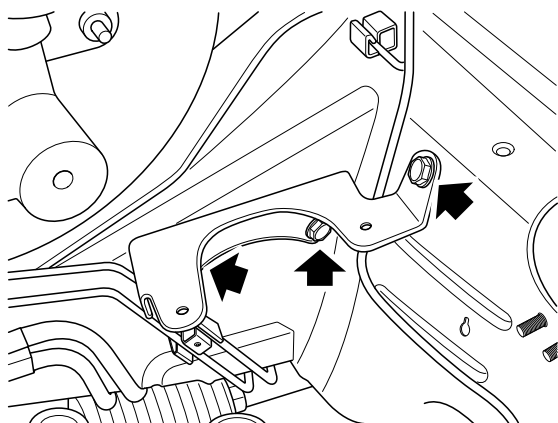
Air Cleaner Assembly Refit

7. Connect the battery negative terminal.

6. Loosen the 2 bolts securing the electronic vacuum pump to the bracket.



7. Loosen the 3 bolts securing the bracket to the body.



Refit

1. Tighten the 3 bolts securing the electronic vacuum pump bracket to the longitudinal member to **19-25 Nm**.
2. Tighten the 2 bolts securing the electronic vacuum pump to the bracket to **8.8 Nm**.
3. Connect the wire harness to the vacuum sensor.
4. Connect the vacuum hose assembly to the vacuum booster.

**Park Brake
Specifications
Torque**

| Description | Value |
|--|------------|
| Nut - Hand Brake Adjustment | 0.8-1.2 Nm |
| Bolt - Cable Secured to Floor | 7-10 Nm |
| Bolt - Secure Cable to Rear Torsion Beam | 19-25 Nm |

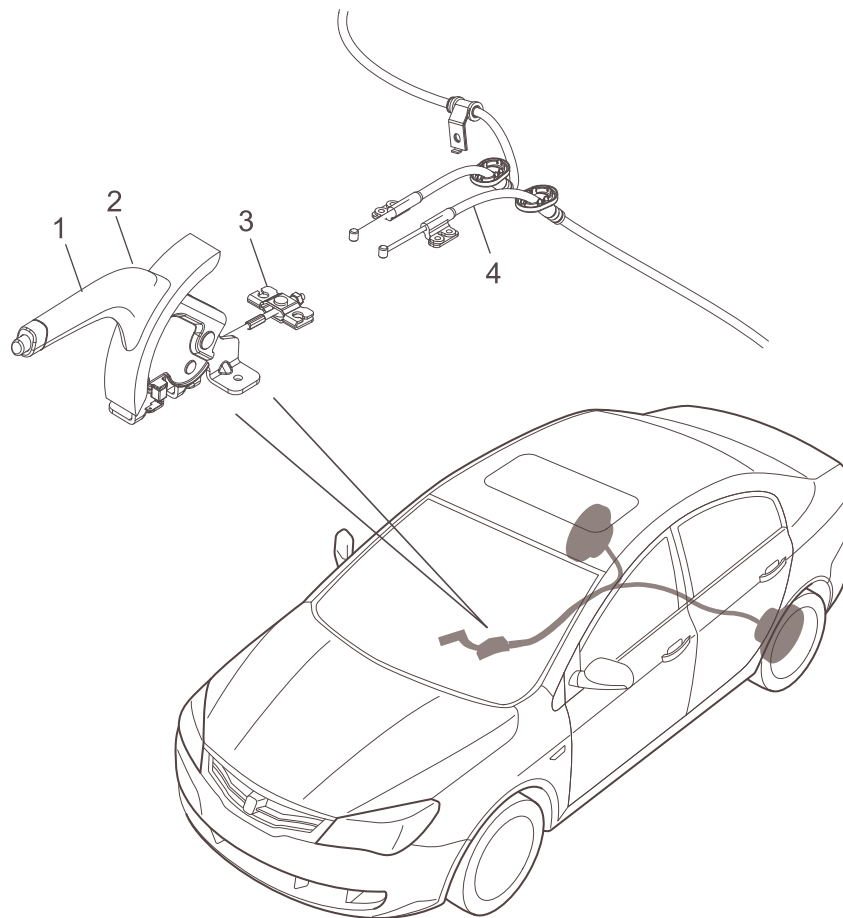
Parameter

| | |
|---------------|-----------|
| Model | |
| Parking Brake | Disc Type |

Description and Operation

System Component Layout

Hand Brake Component Layout



- 1. Hand Brake Control Assembly
- 2. Nut - Hand Brake Adjustment

- 3. Hand Brake Cable Tensioner
- 4. Rear Brake Cable Assembly

Description

6.2.2.1 Hand Brake

The hand brake consists of a combination plier, which is controlled by the cable on the hand brake pull rod assembly between the front seats. The hand brake pull rod assembly is fitted on the centre passage. This system has a traditional ratchet and a release button controlled by the thumb, and they are used to release the hand brake pull rod assembly. A warning switch is fitted on the hand brake lever assembly, and it controls the hand brake warning light located on the instrument pack. When apply the hand brake, the warning switch connects a earth lead to the instrument pack. If the ignition switch turns on, the earth lead lights up the brake

warning light. After the ignition switch turns on every time, the instrument pack will check the brake warning light bulb once. One front cable is connected between the hand brake lever assembly and cable tensioner unit, two hand brake rear cables are connected between the cable tensioner unit and combination plier. With the guide bracket and clamp, secure the cable under the entire vehicle, and then seal the place where the hand brake cable passes through the body passage with rubber rings. When apply the hand brake, the cable tensioner unit makes the hand brake cable apply the same load to the wheel brakes on both sides. The effective length of the cable can be adjusted by the adjusting nut securing the front cable to the hand brake lever assembly.

Service Procedures

Adjustment of Hand Brake

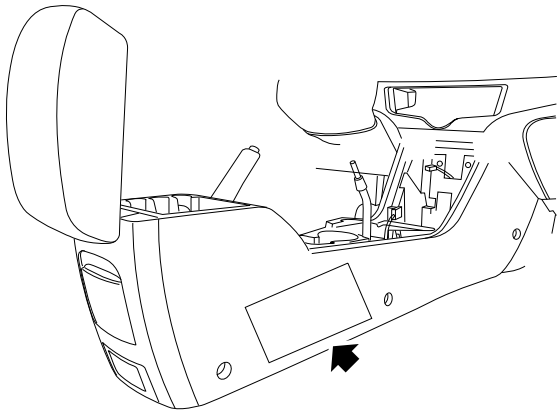
Adjustment

Warning: If possible, perform the road test on a flat and dry surface. Always observe the speed limits and traffic laws while driving.

1. Open the centre console box cover.

Centre Console Assembly

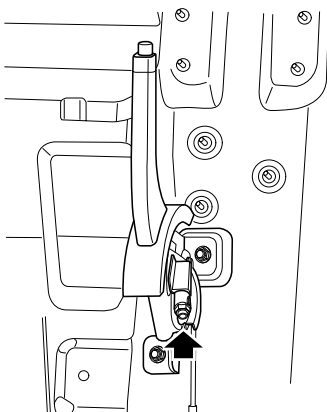
2. Pry the small cover to loose the hand brake adjusting nut, until the nut is flush with the thread end.



3. Raise the vehicle on a lift.

Warning: DO NOT work under the vehicle supported only with a jack. It is essential to support the vehicle on safety stands.

4. Tighten the hand brake adjusting nut, when pull the hand brake to 3rd segment, the torque should be **0.8-1.2 Nm**.



S402010

5. Move the hand brake pull rod up and down sufficiently.
6. Inspect the required force for rotating the rear disc on each wheel. The brake disc must be rotated with little resistance.
7. Loosen the hand brake pull rod and make sure the brake disc can rotate without resistance.
8. Set the ignition key to position II, check the hand brake operation. Apply the hand brake from one segment to

another segment, make sure the following condition occurs:

- a. 1st segment - The rear disc rotates without resistance, and the hand brake warning light on the instrument panel turns on or off.
 - b. 2nd segment - The rear disc rotates with little resistance, and the hand brake warning light on the instrument panel turns on.
 - c. 3rd segment and more - The rear disc locks, and the hand brake warning light on the instrument panel turns on.
9. Set the ignition key to position 0.
 10. Use the small cover to cover the hand brake adjusting nut on the centre console.
 11. Fit the rear wheel.
 12. Lower the vehicle.

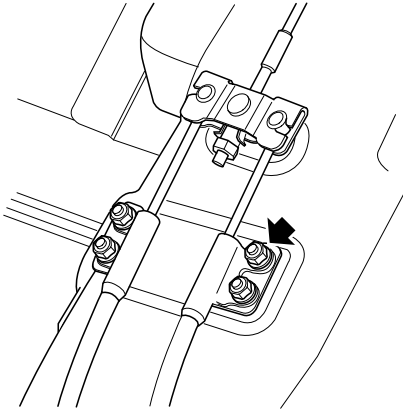
Hand Brake Cable Assembly

Removal

1. Remove the centre console assembly.

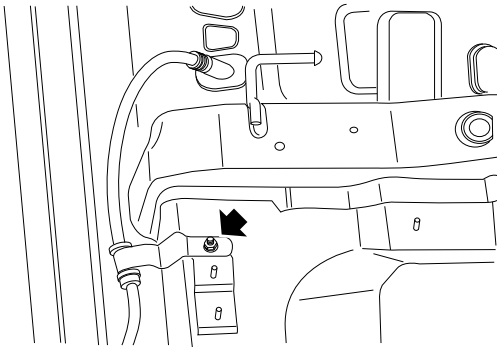
Centre Console Assembly

2. Unscrew the hand brake adjusting nut.
3. Raise the vehicle on a lift.
4. Remove two rear brake cables from the hand brake cable tensioner.



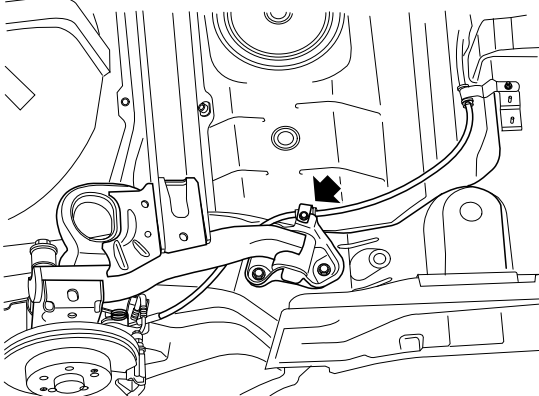
S402009

5. Loosen the hole securing the cable to the body centre path.
6. Loosen the bolt securing the cable to the floor.



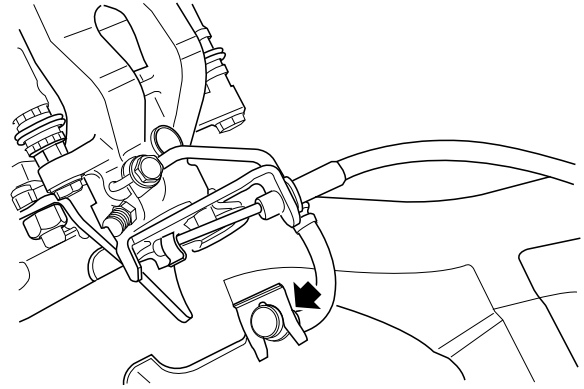
S402011

7. Loosen the bolt securing the cable to the rear torsion beam.



S402012

8. Loosen the clamp securing the cable tie to the rear brake caliper.



S402013

9. Remove the hand brake cable.

Refit

1. Pass the front part of the cable through the hole of the body centre path, then block the hole with the blocking of the cable.
2. Secure the cable to the floor, and tighten the bolt to **7-10 Nm**.
3. Secure the cable to the rear torsion beam, and tighten the bolt to **19-25 Nm**.
4. Pass cable tie through the guide hole of rear brake caliper, and stick the ball joint on the hook of rear brake caliper LH, then stick the cable tie on the guide hole with stick plate.
5. Connect the hand brake cable to cable tensioner.
6. Fit the centre console assembly.

Centre Console Assembly

7. Adjust the hand brake.

Adjustment of Hand Brake

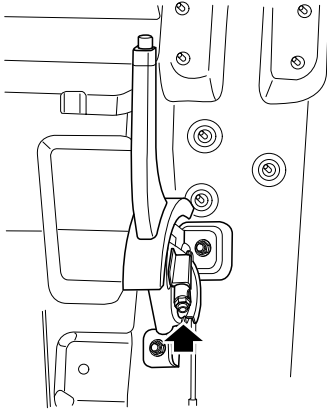
8. Lower the vehicle.

Hand Brake Pull Rod Assembly**Removal**

1. Remove the centre console assembly.

Centre Console Assembly

2. Loosen the hand brake cable adjusting nut and cable.
3. Loosen the bolt securing the hand brake pull rod to body.



S402010

4. Loosen the hand brake warning switch connector, and remove the hand brake warning switch.

Refit

1. Fit the hand brake warning switch to the hand brake pull rod assembly and secure it with the clip.
2. After putting the bolts to the hand brake position in place, tighten the rear/lower unit to the designated place with the specified torque. The torque is **19-25 Nm**.
3. Fit the hand brake adjusting nut, and **DO NOT** tighten it temporarily.
4. Adjust the hand brake.

Adjustment of Hand Brake

5. Fit the centre console assembly.

Centre Console Assembly

Tools List

**Brake Module
Specifications
Torque**

| Description | Value |
|----------------------------------|----------|
| Bolt - ABS to Lower Support | 8-12 Nm |
| Bolt - ABS Lower Support to Body | 19-25 Nm |
| -Rear Brake Line to ABS Adjuster | 20-24 Nm |

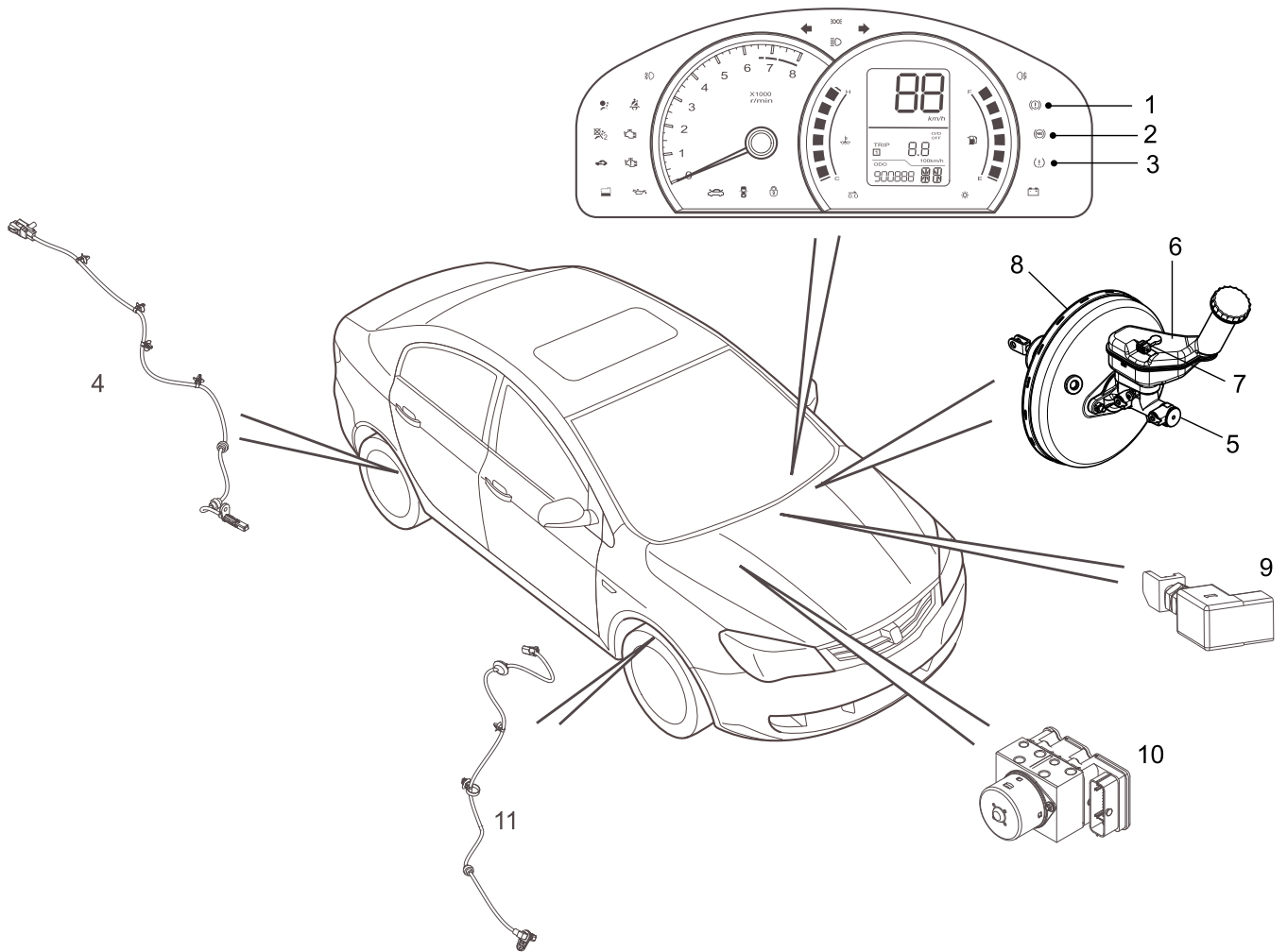
Parameter

| Model | |
|------------------|---|
| ABS Types | TRW EBC450 4-path System with Electronic Brake Force Distribution |

Description and Operation

System Component Layout

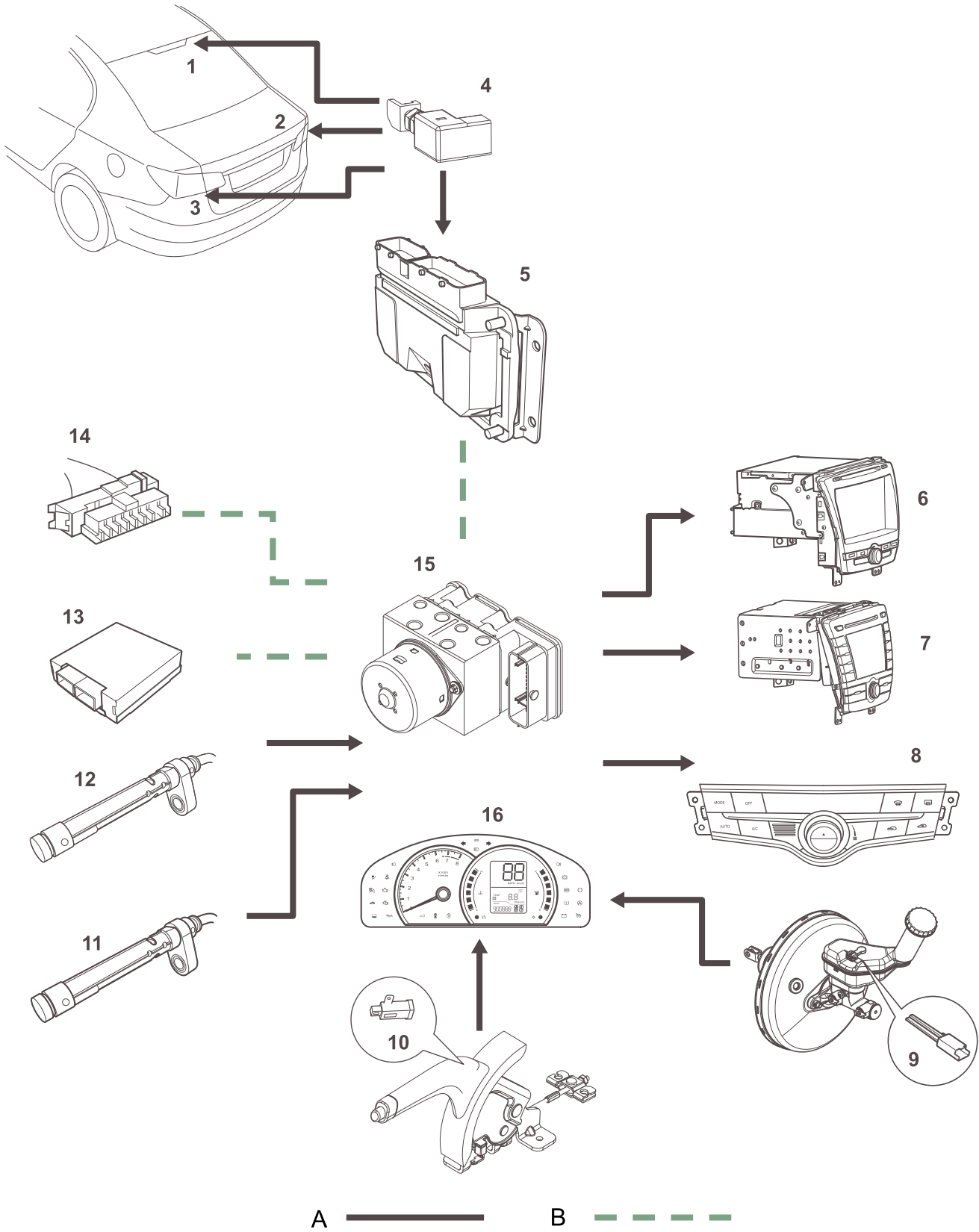
Brake System Control Component Layout



- | | |
|---|---|
| <ul style="list-style-type: none"> 1. Brake System Malfunction Warning Light 2. ABS Malfunction Warning Light 3. TPMS System Warning Light 4. Rear Speed Sensor Assembly 5. Brake Master Cylinder 6. Brake Reservoir | <ul style="list-style-type: none"> 7. Brake Fluid Indication Switch 8. Vacuum Booster 9. Stop Lamp Switch 10. ABS Adjuster ECU 11. Front Speed Sensor Assembly |
|---|---|

System Control Diagram

Brake System Control Diagram



- 1. High Mounted Stop Lamp
- 2. Rear Stop Lamp LH
- 3. Rear Stop Lamp RH
- 4. Stop Lamp Switch

- 5. Engine Control Module
- 6. CD Player
- 7. NAVI Navigation
- 8. **ATC** Automatic Control Air Conditioner

- 9. Brake Fluid Indication Switch
- 10. Hand Brake Warning Switch
- 11. Front Speed Sensor
- 12. Rear Speed Sensor

- 13. Automatic Transmission Control Module
- 14. Diagnostic Interface
- 15. **ABS** Adjuster
- 16. Instrument Pack

Description

ABS Sensor

ABS are active type sensors, which receive the power supply from **ABS** adjuster, and they send the vehicle speed signal to **ABS** adjuster. Sensors are fitted on steering knuckle of each front wheel and the tyre bracket of rear torsion beam, and they are near to the ring gear of each related wheel bearing. When the wheels are rotating, the pole in seal unit generates voltage fluctuation in **ABS** sensor. This voltage fluctuation is converted to square wave signal and input to **ABS** adjuster. The frequency of signal is in proportion to the vehicle speed. When using it in actual conditions, each **ABS** sensor has a connecting lead in the engine bay or boot. Connect the connecting lead to the entire vehicle wire harness.

Pressure Building

When brakes are applied, build brake pressure in the wheel cylinders through the vacuum booster and brake master cylinder. At the moment the normal open valve is open and normal closed valve is closed, and make the wheel speed decrease quickly, until **ABS** identifies the wheels are likely to lock through speed sensor.

During Pressure Increasing

In order to ensure the brake efficiency, after the vehicle reaches a certain speed, **ABS** commands the normal to open valve open and normal closed valve to close again. With the brake pressure increasing, the brake is applied to the wheel again, causing deceleration.

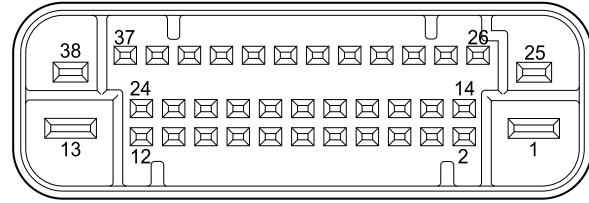
Pressure Holding

To prevent the speed increasing quickly and make sure to produce enough brake efficiency, when **ABS** monitors the wheels lock decreasing to a certain value, it will enter into the pressure holding. At this time, **ABS** closes the normal closed valve remains while the normal open valve is still closed, and keep the pressure in the wheel brakes constant, then the wheel speed increases slowly.

During Pressure Decreasing

When **ECU** identifies the wheels are likely to lock, **ABS** system enter into pressure decreasing. At this time, **ABS** close the normal closed valve, open the normal open valve, and the hydraulic pump begins to operate, the brake fluid flows from the wheel cylinder to the brake master cylinder through the low-pressure cylinder, then the brake pressure decreases, the brake pedal shudders, efficiency of wheel lock decreases, the vehicle speed begins to increases.

ABS Adjuster Connector EB021 End View



S402029

ABS Details of Connector Pin

| Pin Number | Pin Name | Pin Type | Pin Function |
|------------|-----------|--------------|--------------------------|
| 1 | KL30_P | Power Supply | Battery Positive Voltage |
| 2 | - | - | - |
| 3 | WS_RF+ | Power Supply | Wheel Speed FR+ |
| 4 | WS_RF- | Input | Wheel Speed FR- |
| 5 | PUB_CAN_H | Input/Output | CAN Bus Line High |
| 6 | PUB_CAN_L | Input/Output | CAN Bus Line Low |
| 7 | KL30_L | Power Supply | Battery Positive Voltage |
| 8 | - | - | - |
| 9 | - | - | - |
| 10 | WS_RR- | Input | Wheel Speed RR- |
| 11 | WS_RR+ | Power Supply | Wheel Speed RR+ |
| 12 | - | - | - |
| 13 | GND_P | Power Supply | Pump Motor Ground |
| 14 | - | - | - |
| 15 | - | - | - |
| 16 | - | - | - |
| 17 | - | - | - |
| 18 | - | - | - |
| 19 | - | - | - |

Brake Module

| | | | |
|----|--------|--------------|-----------------------|
| 20 | - | - | - |
| 21 | - | - | - |
| 22 | - | - | - |
| 23 | - | - | - |
| 24 | - | - | - |
| 25 | KL30_V | Power Supply | Power Supply to Valve |
| 26 | - | - | - |
| 27 | WS_LF+ | Power Supply | Wheel Speed FL+ |
| 28 | WS_LF- | Input | Wheel Speed FL- |
| 29 | - | - | - |

Brake System

| | | | |
|----|--------|---------------|-----------------------|
| 30 | - | - | - |
| 31 | - | - | - |
| 32 | - | - | - |
| 33 | KL15 | Input | Ignition |
| 34 | | | |
| 35 | WS_LR- | Input | Input Wheel Speed FL- |
| 36 | WS_LR+ | Power | Wheel Speed FL+ |
| 37 | VSO | Supply Output | Vehicle |
| 38 | GND_V | Power Supply | speed Valve Ground |

Operation

During the brake is applied, **ABS** function can prevent the wheel from locking and maintain a stable state even if the vehicle is in an emergency.

Warning: ABS is a auxiliary facility to maintain steering control and steady state during braking:

-
-
-
-

Tip: During normal braking, the feel of the brake pedal on vehicles equipped with ABS is the same with the vehicles without ABS. During anti-lock brake operation, the driver will experience the pulsating of brake pedal and the solenoid/pump motor noise from the ABS Adjuster.

When the conventional brake is applied, **ABS** system does not operate, brake fluid directly enters into each wheel cylinder through HCU path from the reservoir to apply brake pressure to each wheel; Once **ABSECU** detects a wheel lock with speed sensor, **ECU** generate a command to close the intake valve, then the brake fluid does not enter into the wheel cylinder, at the same time turn on the outlet valve to drain the hydraulic pressure of the cylinder to decrease the cylinder hydraulic pressure, so the pressure acts on this wheel will decrease, and the wheel lock will be solved; If detecting that the wheel does not reach lock state, this means that brake force may be not fully used, close the outlet valve, then the brake fluid enters into the wheel cylinder from the intake valve to increase the brake force; If the wheel is in lock threshold state, simultaneously close the inlet and outlet valve, and maintain the brake pressure of the wheel cylinder to fulfill the brake performance.

EBD





EBD is used to optimize distribution of hydraulic pressure between front and rear axle according to the vehicle's load

condition and road conditions to maintain a steady state during the brake is applied. Only **DSCECU** is in normal brake mode, the vehicle's deceleration is 0.3g or more (for the brake pedal load from medium to high), **EBD** functions can be automatically applied in the forward or back up state. **EBD** operation is similar to **ABS**, however, **EBD** has a lower specified wheel slippage limit and **EBD** only acts on rear brakes. During the brake is applied, if the **DSCECU** detects that rear axle is slower than the front axle, in other words, there is a possibility of spinning the wheels, **DSCECU** sends the signals to the hydraulic regulator to close the inlet solenoid valve of the rear wheel brake, and this prevents the rear brake hydraulic pressure from further increasing, but it allows the front brake hydraulic pressure to increase in order to maximize the entire brake force. If the speed of the rear wheels returns to the specified wheel slippage limit range, **DSCECU** will send signals to open the inlet solenoid valve gradually, allowing the hydraulic pressure of the rear axle brakes to increase progressively. **EBD** operation can be felt through the following methods: close the input magnetic valve to make the brake pedal move fiercely, and open the input magnetic valve to make the brake pedal generate a minor pulse. When release the brake pedal, **EBD** the operation stops immediately. The wheel slippage limit that makes the **EBD** run varies depending on the speeds of the entire vehicle.

TPMS

TPMS is an indirect tyre pressure monitoring system, the system cannot directly measure the tyre pressure, it can detect the tyre expansion based on the relative speed of the four wheels. The lack of tyre pressure can be detected by the different speeds compared with other wheels. When the tyre is lack of pressure compared with other tyre pressure, the system warns the driver that the tyre is lack of pressure.

Warning Light and Text Information

| | | | |
|----------------|------------------|--|---|
| | | ABS | Brake system |
| Activated | Light | None | Not Applicable |
| | Text Information | None | Not Applicable |
| Cancelled | Light | Not Applicable | Not Applicable |
| | Text Information | Not Applicable | Not Applicable |
| Malfunctioning | Light |  |  |
| | | Refer to Note 1 | Refer to Note 1 |
| | Text Information |  |  |

Important:

1. If **CAN** information cannot be received, it will remain illuminated.
2. Text information only displays for 5 seconds.
3. There are several kinds of text information, such as **EBD** malfunction, brake fluid level is too low and hand brake is in open condition.

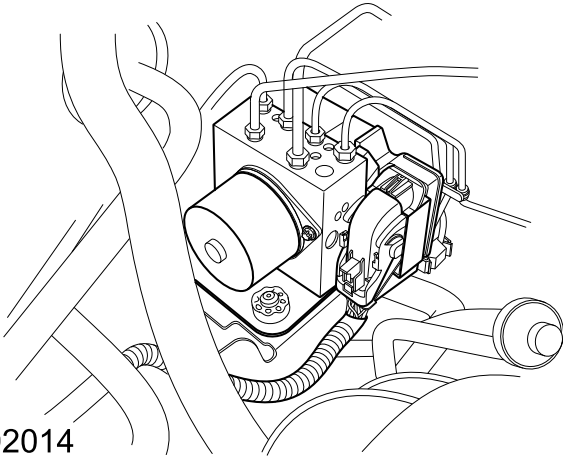
Service Procedures

ABS Adjuster

Removal

1. Remove the ignition key, disconnect the battery ground.
2. Place the cloth under the **ABS** adjuster to absorb the overflowing fluid.

Caution: *The brake fluid can damage the painted surface. If the fluid spills, immediately remove the fluid and clean this area with water.*



S402014

3. Disconnect the connector from **ABS** adjuster.
4. Disconnect 2 inlet oil brake pipes from **ABS** adjuster.

Caution: *Before disconnecting or removing brake lines, ensure that the centre area around lines and connections are clean. Plug opened connection to prevent contamination entering.*

5. Record 4 positions on **ABS** adjuster outlet oil pipe for assembling, and then disconnect the brake outlet pipe from the top of **ABS** adjuster.
6. Remove a bolt and 2 nuts securing the **ABS** adjuster to the lower mounting bracket to body, and remove **ABS** adjuster lower support and **ABS** adjuster.
7. Remove 3 bolts securing the **ABS** adjuster to the lower support.
8. Remove **ABS** adjuster assembly.

Refit

1. Position **ABS** adjuster to lower support, then fit the bolts and tighten it to **8-12 Nm**.
2. Fit **ABS** adjuster lower support to the body, and make sure to insert into retaining seal ring properly. Tighten the bolts to **19-25 Nm**.
3. Clean the brake hard tube joint.
4. Connect inlet pipe and outlet brake pipe to **ABS** regulator, and make sure that the pipes are connected to corresponding ports. Tighten the brake hard tube joint to **20-24 Nm**.
5. Connect the connector to **ABS** adjuster.

6. Connect the battery earth lead.
7. Drain the brake system.

Drain Brake System

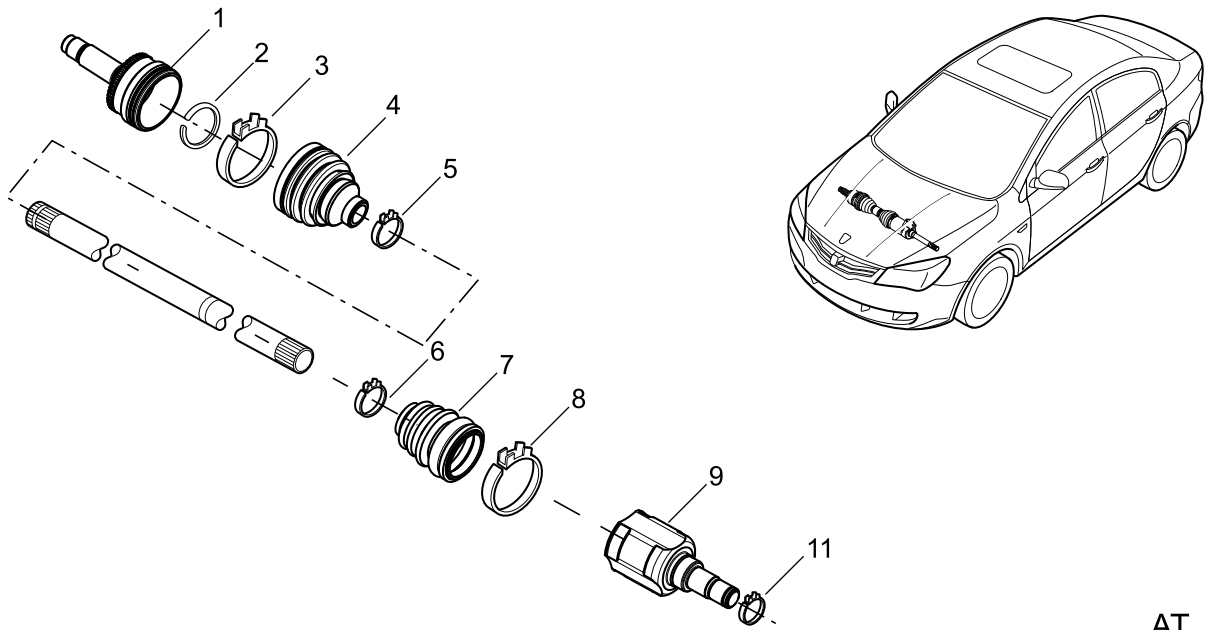
**Drive Axle
Specifications
Torque**

| Description | Value |
|--|------------|
| Bolt - Front Hub to Front Lower Arm Ball Joint | 50-70 Nm |
| Nut - Steering Rod Outer Ball Joint | 35-45 Nm |
| Bolt - Anti Roll Bar to Anti Roll Bar Link | 40-60 Nm |
| Nut - Front Drive Shaft | 350-370 Nm |
| Bolt - Wheel | 100-120 Nm |

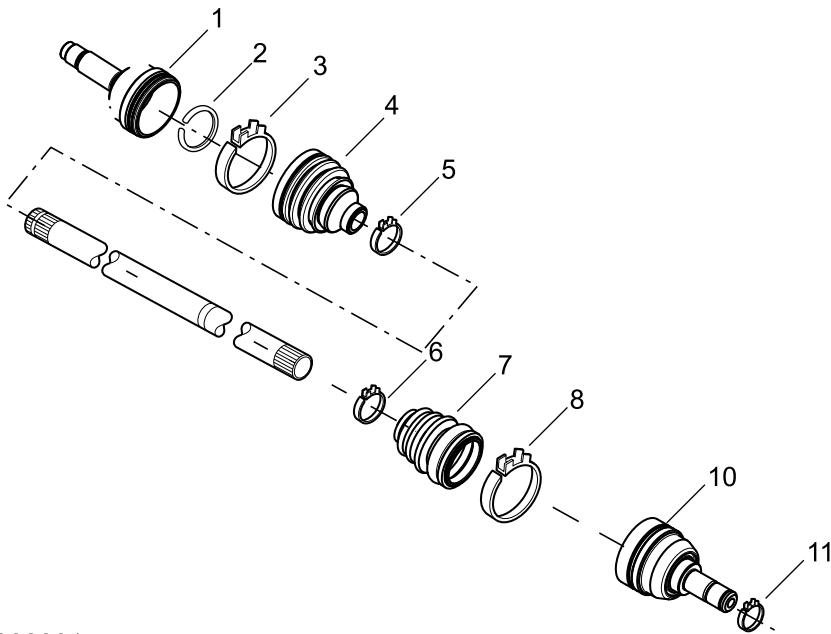
Description and Operation

System Component Layout

RH Drive Shaft Component Layout



AT

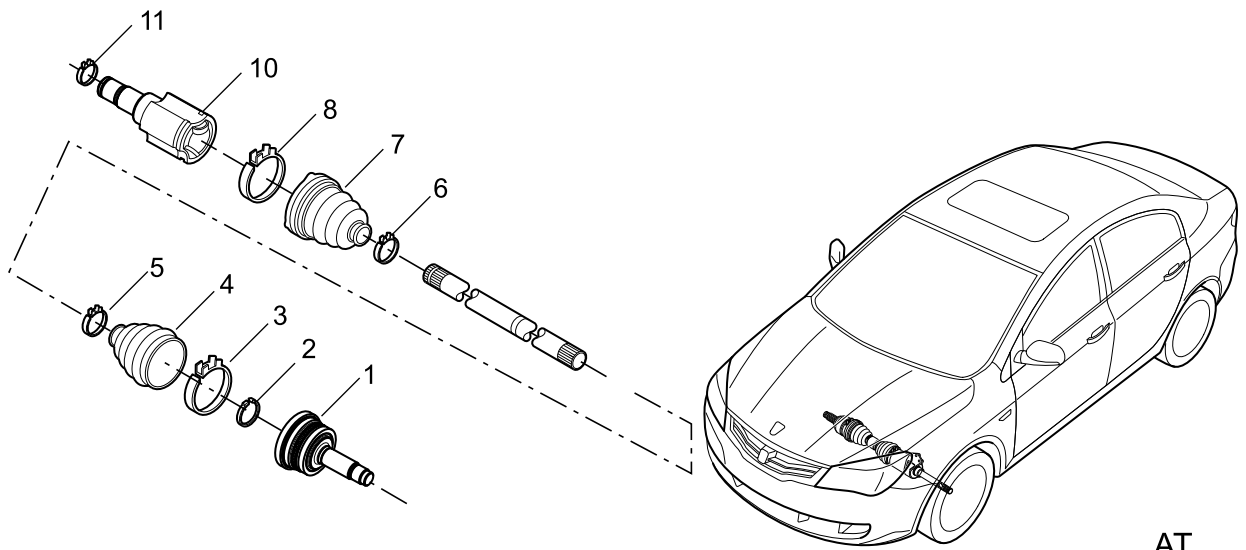


S302001

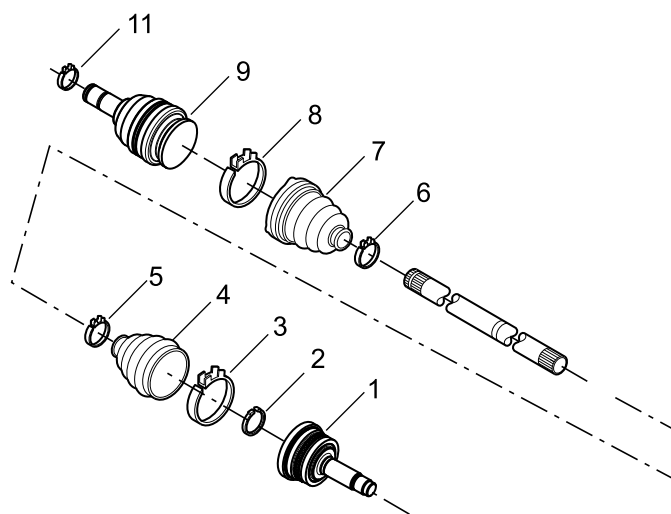
MT

- | | |
|---|---|
| 1. Constant Velocity Joint Assembly RH | 7. Inner Joint Assembly Gaiter RH |
| 2. Constant Velocity Joint Snap Ring RH | 8. Clamp (Big) |
| 3. Clamp (Big) | 9. Tripod Joint Assembly RH |
| 4. Constant Velocity Joint Assembly Gaiter RH | 10. Inner Constant Velocity Joint Assembly RH |
| 5. Clamp (Small) | 11. Circlip |
| 6. Clamp (Small) | |

LH Drive Shaft Component Layout



AT



MT

S302000

- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Constant Velocity Joint Assembly LH 2. Constant Velocity Joint Snap Ring LH 3. Clamp (Big) 4. Constant Velocity Joint Assembly Gaiter LH 5. Clamp (Small) 6. Clamp (Small) | <ul style="list-style-type: none"> 7. Inner Joint Assembly Gaiter LH 8. Clamp (Big) 9. Inner Constant Velocity Joint Assembly LH 10. Tripod Joint Assembly LH 11. Circlip |
|--|--|

Description

The drive shaft is an integral shaft with tripod joint assembly and constant velocity joint assembly, one integral shaft is fitted on the right side of the transmission case, and the other is fitted on the left side, and connected to the differential. Tripod joint assembly has three feet with ball gaskets to reduce slide resistance. The constant velocity joint assembly is Rzeppa type,

connecting the spline and intermediate shaft, and secured with a snap ring, the inner constant velocity joint can retract inner and outer, which is full of grease, and protected by the rubber gaiter.

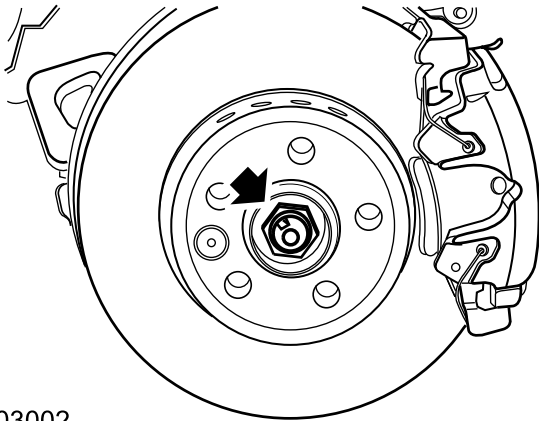
The drive shaft is transmitted the engine torque to the front wheel through the transmission case.

Service Procedures

Drive Shaft Assembly RH

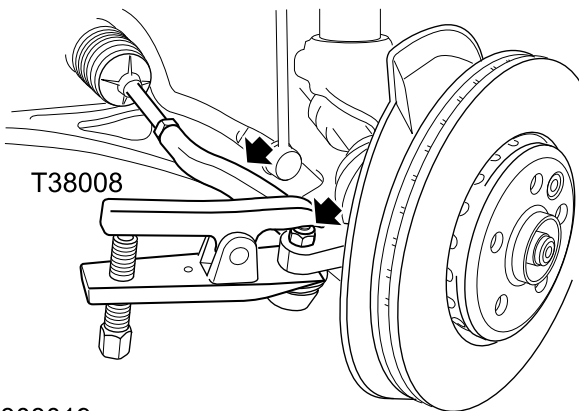
Removal

1. Raise the vehicle on a lift.
2. Unscrew the FR wheel bolt.
3. Remove the FR wheel assembly.



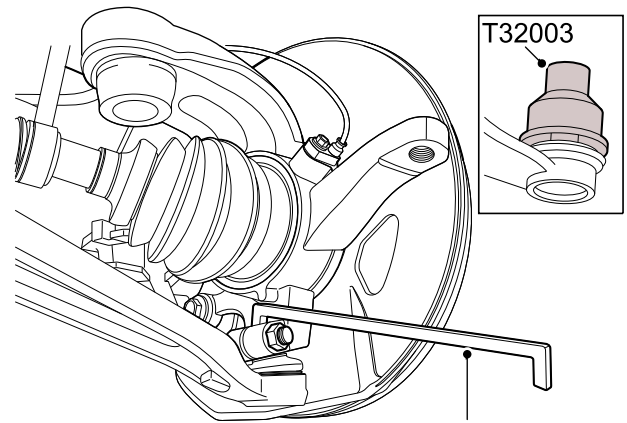
S303002

4. Knock back drive shaft nut stake, press the brake pedal, remove and dispose of the drive shaft nut.
5. Unscrew the steering rod spring pin and release nut.



S303019

6. Use the tool **T38008** to release the steering rod ball joint.
7. Unscrew the nut securing the anti roll bar link to the anti roll bar, and release the anti roll bar link.
8. Unscrew the nuts and bolts securing the front lower arm to the front hub.

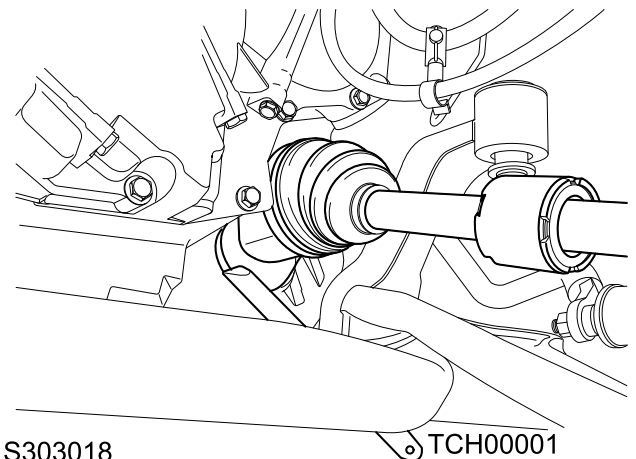


S303011

9. Use the special tool **T32011** to release the front lower arm outer ball joint.

Caution: Operate carefully and DO NOT damage the rubber protector of the front lower arm outer ball joint when removing

10. Pull the front hub outward, and remove the drive shaft assembly from the hub.



S303018

11. Use the special tool **TCH00001** to separate the drive shaft assembly from the differential.
12. Remove the drive shaft assembly and dispose of the circlip.

Refit

1. Fit the new circlip to the drive shaft RH.
2. Clean the drive shaft end and the mating area between the hub and the differential.
3. Fit the drive shaft to the differential and ensure the full engagement.
4. Remove the front lower arm outer ball joint gaiter.
5. Pull the hub outward to engage the drive shaft and the hub spline, and fit the hub to the lower arm outer ball joint.
6. Fit the nut and bolt securing the lower arm to the hub, and tighten the bolt to **50-70 Nm**.
7. Make sure that the lower arm ball joint pin is fully

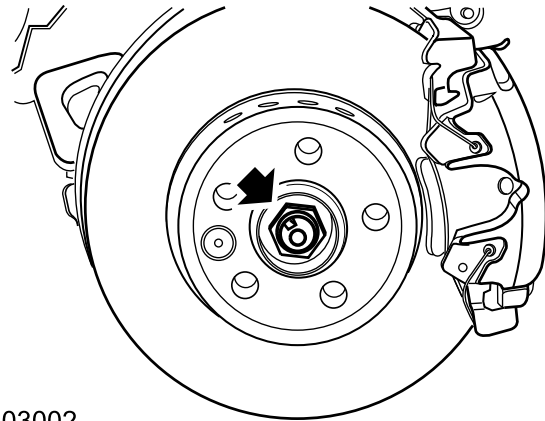
engaged with the hub, and the bolt is located in the groove of the ball joint.

8. Make sure that the steering rod ball joint and steering arm are clean, and the rubber protector is not damaged.
9. Fit the steering rod to the steering arm, and tighten the nut to **35-45 Nm**.
10. Fit the spring pin and bend it to avoid dropping.
11. Make sure that the contact surface of anti roll bar and the anti roll bar link is clean.
12. Position the anti roll bar link onto the anti roll bar, fit and tighten the nut to **40-60 Nm**.
13. Fit a new drive shaft nut, and tighten the nut to **350-370 Nm**.
14. Stake the nut to the drive shaft.
15. Fit the front wheel RH and bolt, and tighten the bolt to **100-120 Nm**.
16. Lower the vehicle.

Drive Shaft Assembly LH

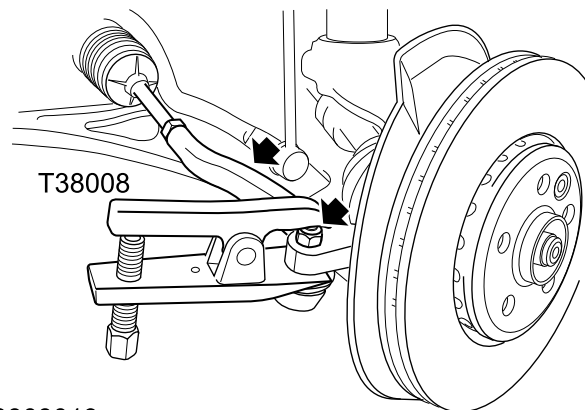
Removal

1. Raise the vehicle on a lift.
2. Unscrew the wheel bolt FL.
3. Remove the wheel assembly FL.



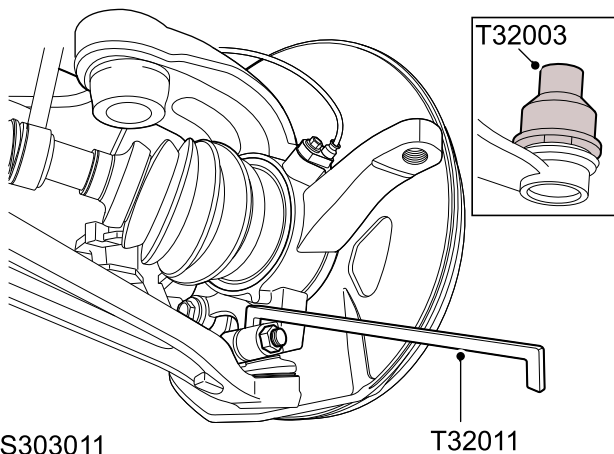
S303002

4. Knock back drive shaft nut stake, press the brake pedal, remove and dispose of the drive shaft nut.
5. Remove the steering rod spring pin and unscrew the steering rod set nut.



S303019

6. Use the special tool **T38008** to release the steering rod ball joint.
7. Release the nut securing the anti roll bar link to the anti roll bar, and release the anti roll bar link.
8. Unscrew the nuts and bolts securing the front lower arm to the front hub.



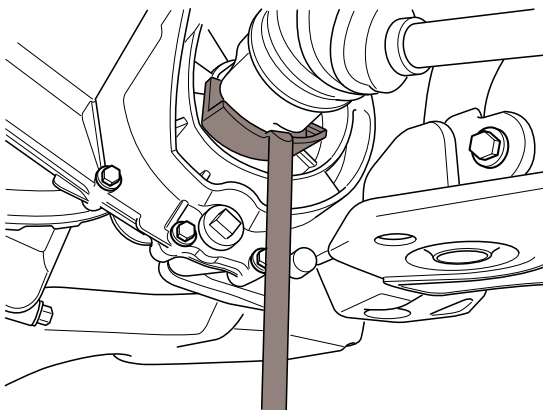
S303011

T32011

9. Use the special tool **T32011** to remove front lower arm outer ball joint.

Caution: Operate carefully and **DO NOT** damage the rubber protector of the front lower arm outer ball joint when removing

10. Pull the front hub outward, and remove the drive shaft assembly from the hub.



11. Use the Special Tools **TCH00001** to separate the drive shaft assembly from the differential.
12. Remove the drive shaft assembly and dispose of the circlip.

Refit

1. Fit the new circlip to the drive shaft LH.
2. Clean the drive shaft end and the mating area between the hub and the differential.
3. Fit the drive shaft to the differential and ensure the full engagement.
4. Remove the front lower arm outer ball joint gaiter.
5. Pull the hub outward to engage the drive shaft and the hub spline, and fit the hub to the lower arm outer ball joint.
6. Fit the nut and bolt securing the lower arm to the hub, and tighten the bolt to **50-70 Nm**.
7. Make sure that the lower arm ball joint pin is fully

engaged with the hub, and the bolt is located in the groove of the ball joint.

8. Make sure that the steering rod ball joint and steering arm are clean, and the rubber protector is not damaged.
9. Fit the steering rod to the steering arm, and tighten the nut to **35-45 Nm**.
10. Fit the spring pin and bend it to avoid dropping.
11. Make sure that the contact surface of anti roll bar and the anti roll bar link is clean.
12. Position the anti roll bar link onto the anti roll bar, fit and tighten the nut to **40-60 Nm**.
13. Fit a new drive shaft nut, and tighten the nut to **350-370 Nm**.
14. Stake the nut to the drive shaft.
15. Fit the front left wheel and bolt, and tighten the bolt to **100-120 Nm**.
16. Lower the vehicle.

Outer Constant Velocity Joint Gaiter

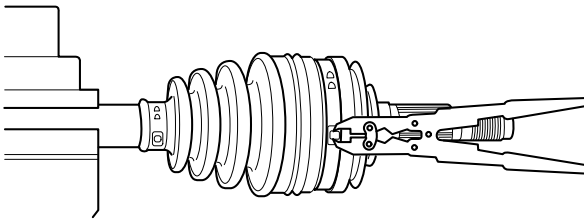
Removal

1. Remove the drive shaft assembly.

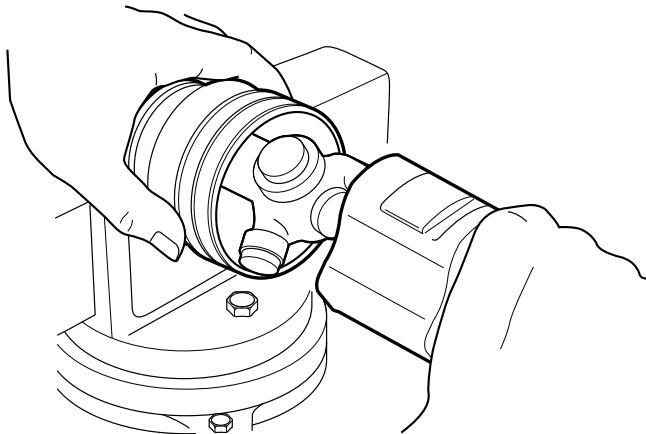
 **Drive Shaft Assembly LH**

 **Drive Shaft Assembly RH**

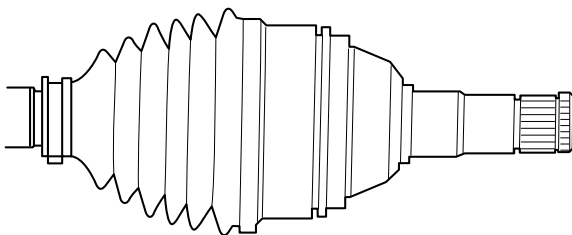
2. Place the drive shaft clamp in a vise.



3. Remove the inner constant velocity joint or tripod joint gaiter clamp and dispose of it.



4. Remove the inner constant velocity joint or tripod joint assembly.
5. Remove the inner constant velocity joint or tripod joint assembly gaiter and dispose of it.



6. Remove the outer constant velocity joint clamp and dispose of it.
7. Remove the outer constant velocity joint assembly

gaiter from the inner joint and dispose of it.

Refit

1. Clean the drive shaft inner and outer joint.
2. Use a tape to wrap the drive shaft bar.
3. Carefully position the outer constant velocity joint gaiter into the outer joint along the shaft bar.
4. Apply the grease to the outer constant velocity joint assembly.
5. Tighten the gaiter respectively with the large and small clamp.
6. Position the inner joint gaiter and clamp into the shaft bar.
7. Remove the tape from the shaft bar.
8. Fit the inner joint snap ring and apply grease to it.
9. Tighten the inner joint gaiter with the clamp.
10. Fit the drive shaft assembly.

 **Drive Shaft Assembly LH**

 **Drive Shaft Assembly RH**

Tripod Joint - Inner

 **Drive Shaft Assembly RH**

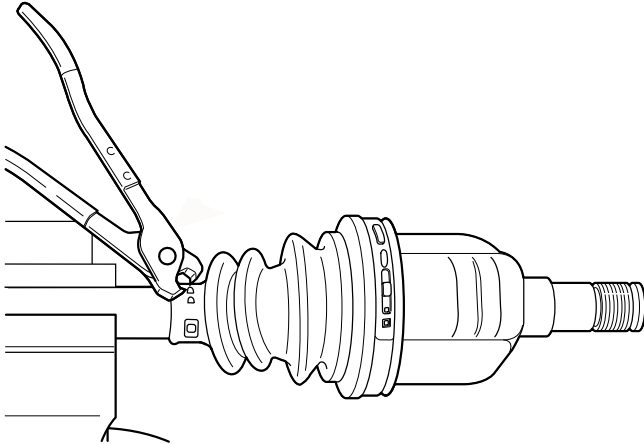
Removal

1. Remove the drive shaft assembly.

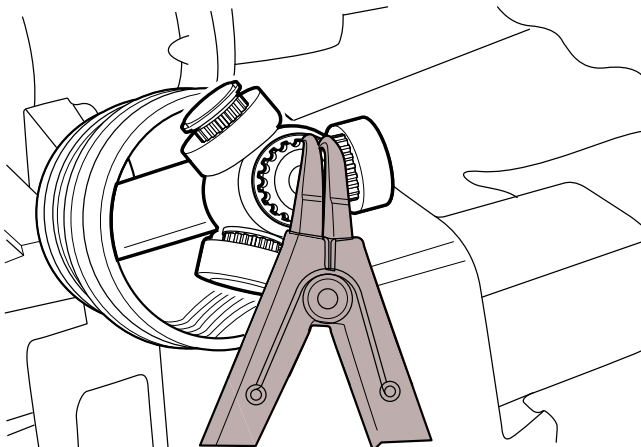
 **Drive Shaft Assembly LH**

 **Drive Shaft Assembly RH**

2. Place the drive shaft clamp in a vise.



3. Release two clamps and dispose of them.
4. Remove the drive shaft intermediate shaft.



5. Remove the snap ring of the drive shaft intermediate shaft end and dispose of it.
6. Remove the tripod joint from the drive shaft intermediate shaft.
7. Remove the tripod joint rubber gaiter and dispose of it.

Refit

1. Clean the drive shaft and tripod joint assembly gaiter.
2. Fit 2 clamp boots to the drive shaft.
3. Position the new tripod joint to the drive shaft.
4. Fit the new snap ring to the drive shaft intermediate shaft.
5. Apply grease to the inside of the tripod joint assembly.
6. Set the tripod joint assembly gaiter to the drive shaft.
7. Fit the drive shaft assembly.

 **Drive Shaft Assembly LH**

CV Joint - Inner

Removal

 **Drive Shaft Assembly LH**

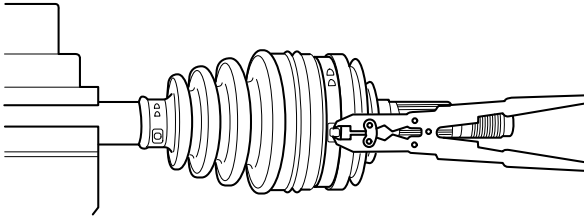
 **Drive Shaft Assembly RH**

1. Remove the drive shaft assembly.

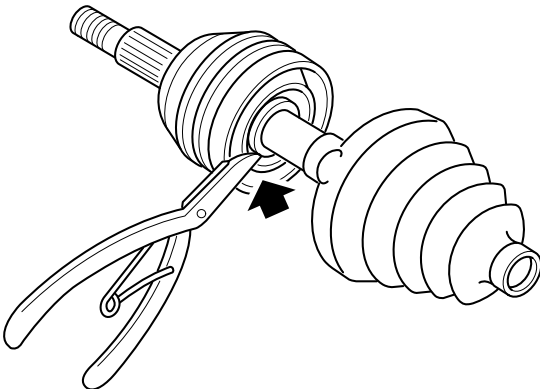
 **Drive Shaft Assembly LH**

 **Drive Shaft Assembly RH**

2. Place the drive shaft clamp in a vise.



3. Remove the inner constant velocity joint gaiter clamp and dispose of it.



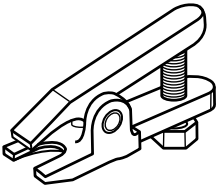
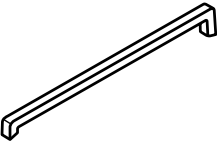
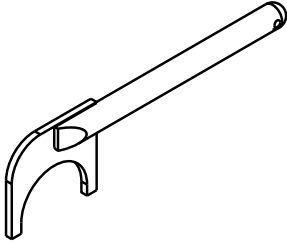
S303014

4. Wipe grease off the inner joint, and remove the spring securing the inner joint with a circlip plier and dispose of it.
5. Remove the inner ball joint. Remove inner ball joint gaiter from the solid shaft and dispose of it.

Refit

1. Clean the fitting area of the solid shaft and ball joint.
2. Carefully set a new clamp and inner ball joint gaiter from the solid shaft.
3. Fit a new inner constant velocity joint to the solid shaft.
4. Secure the circlip to the inner ball joint with the circlip pliers.
5. Apply inner ball joint with the recommended grease.
6. Tighten the two clamps of the inner ball joint to ensure a seal.
7. Fit the drive shaft assembly to the vehicle.

Special Tools

| Tool Number | Description | Picture |
|-------------|--------------------------------------|---|
| T38008 | Ball Joint Removal Fixture |  <p>T38008</p> |
| T32011 | Lower Arm Ball Joint Disengage Lever |  <p>T32011</p> |
| TCH00001 | Drive Shaft Remover |  <p>TCH00001</p> |

Instrument Panel and Console**Specifications****Torque**

| Description | Value |
|--|--------------|
| Bolt - Front of Instrument Panel Air Conditioner to Body | 5-6 Nm |
| Bolt - Left Side of Instrument Panel to Body | 17-23 Nm |
| Bolt - Right Side of Instrument Panel to Body | 17-23 Nm |
| Bolt - Instrument Panel Member to Centre Floor Driver Side Small Bracket | 17-23 Nm |
| Bolt - Instrument Panel Member to Centre Floor Passenger Side Small Bracket | 17-23 Nm |
| Bolt - Ground Bolt | 10-12 Nm |
| Bolt - Passenger Side Heater Sealing Plate | 2.7-3.3 Nm |
| Bolt - Driver Side Heater Sealing Plate | 2.7-3.3 Nm |
| Nut - Union Expansion Valve | 19.6-24.5 Nm |
| Bolt - Upper Instrument Panel Assembly to Instrument Panel Member | 6-8 Nm |
| Screw - Lower Instrument Panel Assembly to Upper Instrument Panel Assembly and Instrument Panel Member | 1.3-1.9 Nm |
| Bolt - Lower Instrument Panel Assembly to Upper Instrument Panel Assembly and Instrument Panel Member | 6-8 Nm |
| Nut - Lower Instrument Panel Assembly to Upper Instrument Panel Assembly and Instrument Panel Member | 1.7-2.3 Nm |
| Screw - Glove Box Frame to Lower Instrument Panel | 1.3-1.9 Nm |
| Bolt - Glove Box Frame to Lower Instrument Panel | 6-8 Nm |
| Screw - Instrument Side Panel to Upper Instrument Panel and Instrument Panel Member | 1.3-1.9 Nm |
| Screw - Air Conditioning Control Panel to Lower Instrument Panel | 1.3-1.9 Nm |
| Bolt - Front of Centre Console to Lower Instrument Panel | 2.7-3.3 Nm |
| Bolt - Left and Right Sides of Centre Console to Bracket | 2.7-3.3 Nm |
| Bolt - Centre Console Armrest Box to Rear Mounting Bracket | 2.7-3.3 Nm |

Service Procedures

Instrument Panel (I/P) Assembly

Removal

1. Disconnect the battery negative terminal.
2. Remove the front door.

Front Door

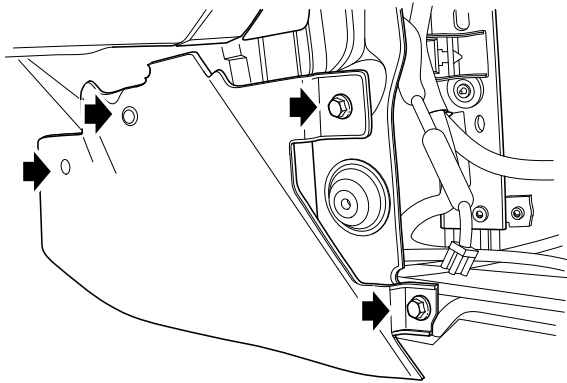
3. Remove the front seat.

Front Seat

4. Remove the centre console assembly.

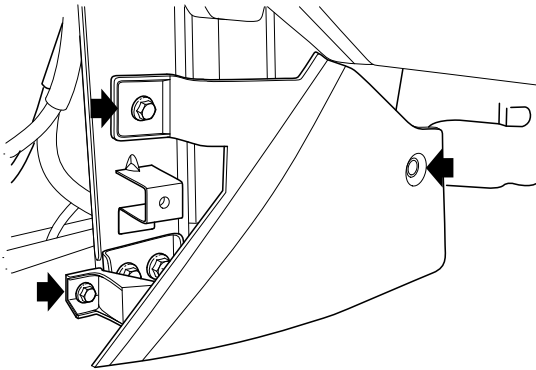
Centre Console Assembly

5. Remove the driver side heater sealing plate.



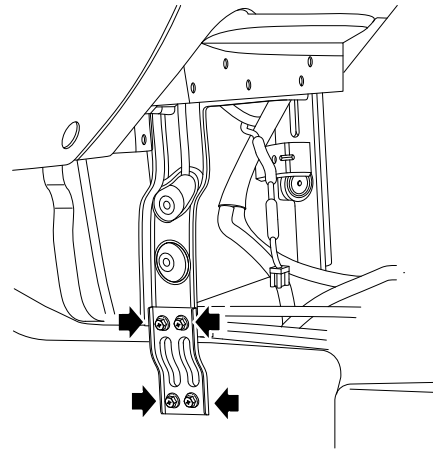
S81001

6. Remove the passenger side heater sealing plate.



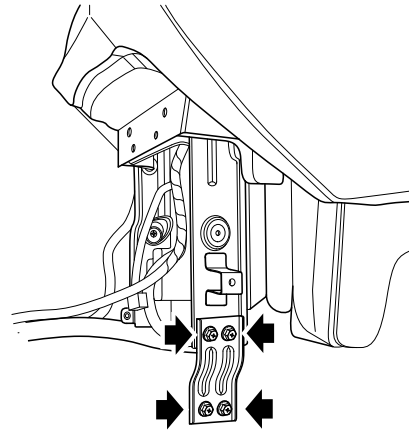
S81002

7. Unscrew the 4 bolts securing the instrument panel member to the centre floor driver side small bracket.



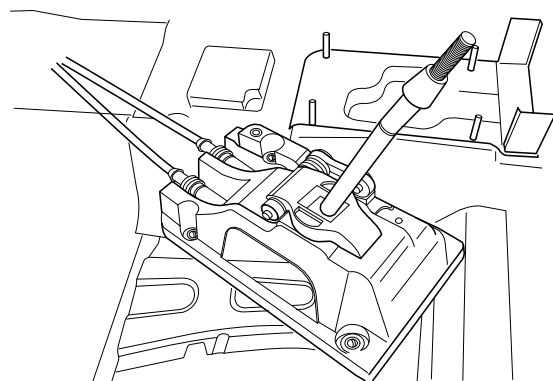
S81003

8. Unscrew the 4 bolts securing the instrument panel member to the centre floor passenger side small bracket.



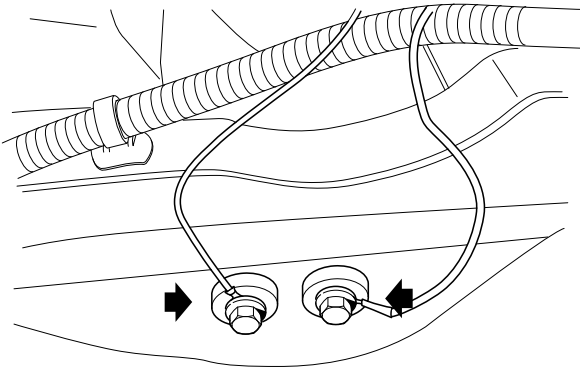
S81004

9. Loosen the gearshift and place it aside.



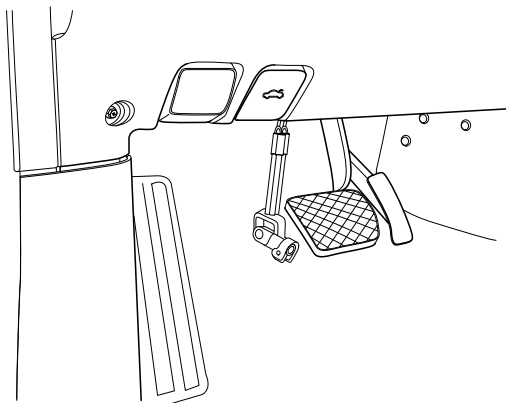
S81005

10. Turn back the floor carpet on the right side of the gearshift, then unscrew the 2 ground bolts.



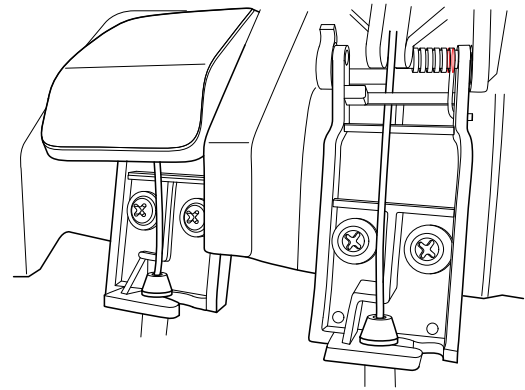
S81006

11. Pull the air conditioner weeping pipe out from the body weeping hole.
12. Loosen the steering column joint.



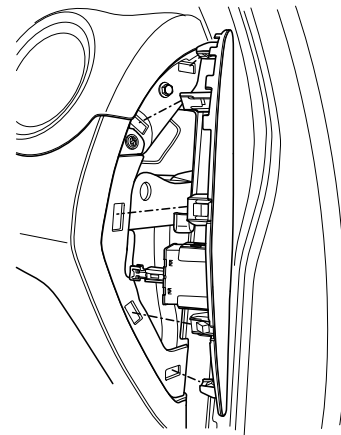
S81007

13. Remove the instrument panel end surface cover plate LH.
14. Remove the A pillar lower trim panel LH.
✎ **A Pillar Lower Trim Panel**
15. Remove the A pillar upper trim panel LH.
✎ **A Pillar Upper Trim Panel**
16. Remove the A pillar centre trim panel LH.
17. Disconnect the connector connecting the instrument panel LH to the body wire harness.
18. Disconnect the bonnet release cable from the engine cover opener handle.
19. Disconnect the fuel flap release cable from the fuel filler door opener handle assembly.



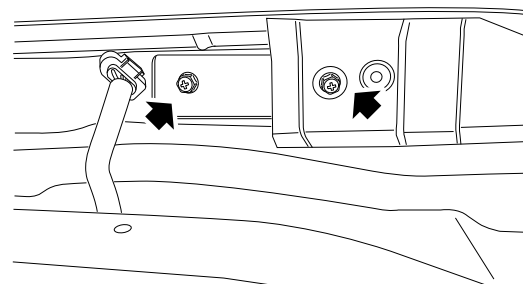
S81008

20. Release the PAB switch (if equipped), then remove the instrument panel end surface cover plate RH.



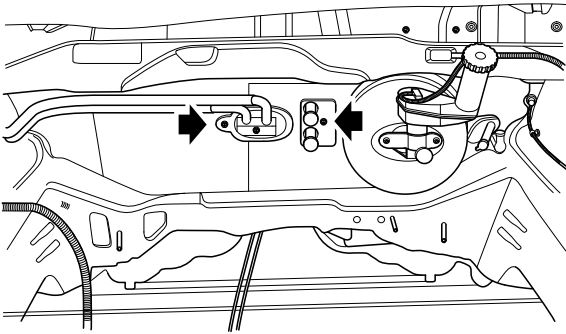
S81009

21. Remove the A pillar lower trim panel RH.
✎ **A Pillar Lower Trim Panel**
22. Remove the A pillar upper trim panel RH.
✎ **A Pillar Upper Trim Panel**
23. Remove the A pillar centre trim panel RH.
24. Disconnect the connector connecting the instrument panel RH to the body wire harness.
25. Remove the air conditioner air intake grille.
✎ **Air Conditioner Air Intake Grille**
26. Remove the wiper motor and link assembly.
✎ **Wiper Assembly**
27. Unscrew the 2 bolts securing the front of the instrument panel air conditioner to the body.



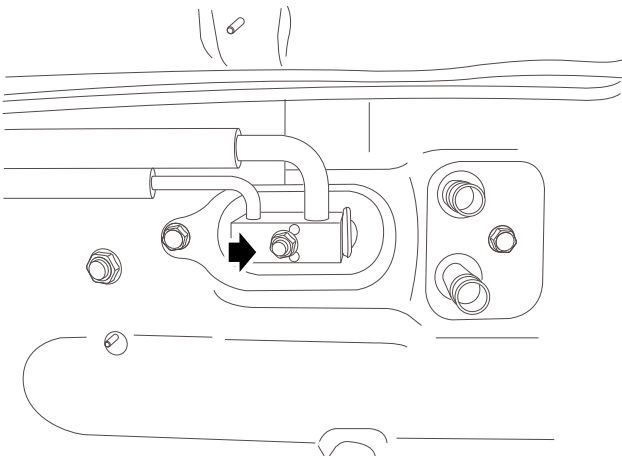
28. Unscrew the 2 bolts securing the front of the

instrument panel on one side of the engine bay to the body.

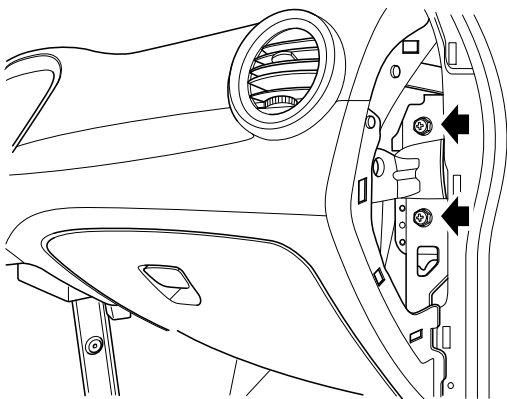


S81013

29. Disconnect the air conditioner water inlet pipe.
30. Disconnect the air conditioner water outlet pipe.
31. Unscrew a nut securing the expansion valve to the instrument panel assembly.

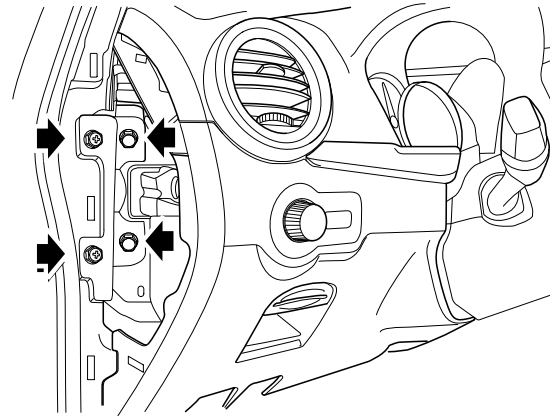


32. Unscrew the 2 bolts securing the right side of the instrument panel to the body.



S81014

33. Unscrew the 4 bolts securing the left side of the instrument panel to the body.



S81015

34. Carry out the instrument panel and its support member from the body with the help.

Refit

1. Fit the instrument panel and its support member in the vehicle with the help.
2. Secure the front side of the instrument panel to the body on one side of the engine bay, then fit the bolt and tighten to **17-23 Nm**.
3. Secure the front of the instrument panel air conditioner to the body, then fit the bolt and tighten to **5-6 Nm**.
4. Fit the wiper motor and link assembly.

Wiper Assembly

5. Fit the air conditioner air intake grille.

Air Conditioner Air Intake Grille

6. Secure the left side of the instrument panel to the body, then fit the bolt and tighten to **17-23 Nm**.
7. Secure the right side of the instrument panel to the body, then fit the bolt and tighten to **17-23 Nm**.
8. Align the air conditioner weeping pipe with the body weeping hole, and place the pipe into the hole.
9. Fit the gearshift.
10. Secure the instrument panel beam to the centre floor driver side small bracket, then fit the bolt and tighten to **17-23 Nm**.
11. Secure the instrument panel beam to the centre floor passenger side small bracket, then fit the bolt and tighten to **17-23 Nm**.
12. Fit the ground bolt and tighten to **10-12 Nm**.
13. Secure the passenger side heater sealing plate to the instrument panel assembly, then fit the bolt and tighten to **2.7-3.3 Nm**.
14. Secure the driver side heater sealing plate to the instrument panel assembly, then fit the bolt and tighten to **2.7-3.3 Nm**.
15. Fit the centre console assembly.

Centre Console Assembly

16. Fit the steering column joint.
17. Connect the fuel flap release cable into the fuel filler door opener handle of the lower instrument panel.
18. Connect the bonnet release cable into the engine opener handle.
19. Connect the air conditioner water inlet pipe.
20. Connect the air conditioner water outlet pipe.
21. Secure the expansion valve to the instrument panel with the nut, and tighten the nut to **19.6-24.5 Nm**.
22. Connect the connector connecting the instrument panel LH to the body wire harness.
23. Fit the A pillar upper trim panel LH.

 **A Pillar Upper Trim Panel**

24. Fit the A pillar lower trim panel LH.

 **A Pillar Lower Trim Panel**

25. Fit the A pillar centre trim panel LH.
26. Fit the instrument panel end surface cover plate LH.
27. Connect the connector connecting the instrument panel RH to the body wire harness.
28. Fit the A pillar upper trim panel RH.

 **A Pillar Upper Trim Panel**

29. Fit the A pillar lower trim panel RH.

 **A Pillar Lower Trim Panel**

30. Fit the A pillar centre trim panel RH.
31. Fit the instrument panel end surface cover plate RH, and tighten the PAB switch (if equipped).
32. Fit the front seat.

 **Front Seat**

33. Fit the front door.

 **Front Door**

34. Connect the battery negative terminal.

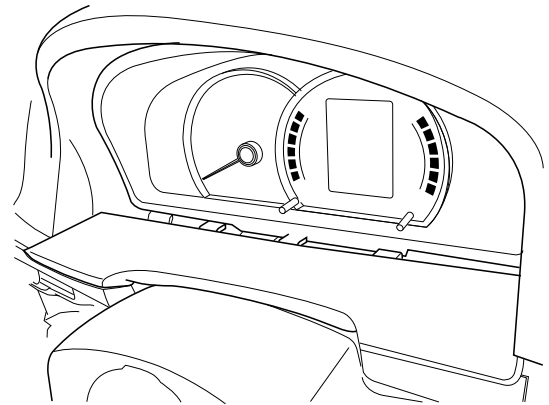
Upper Instrument Panel Assembly

Removal

1. Disconnect the battery negative terminal.
2. Remove the instrument panel assembly.

 **Instrument Panel Assembly**

3. Remove the meter trim frame and the steering column upper protector.



S82001

4. Remove the instrument pack from the upper instrument panel assembly.

 **Instrument Pack**

5. Remove the driver side panel.

 **Driver Side Panel**

6. Remove the centre control panel assembly.

 **Centre Control Panel Assembly**

7. Remove the steering wheel and the steering column assembly.

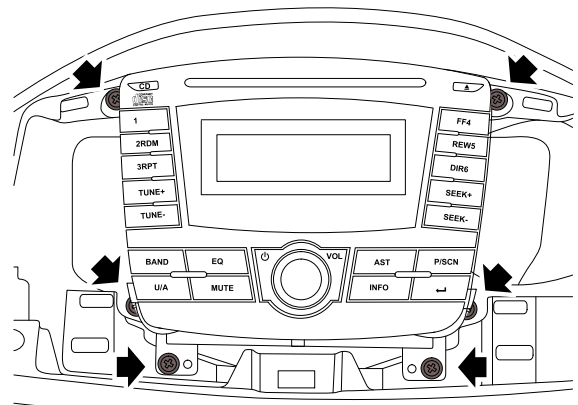
 **Steering Wheel Assembly**

 **Steering Column Assembly**

8. Remove the right garnish.

 **Right Garnish**

9. Remove the navigation (advanced configuration)/radio (medium and low configuration).



S82002

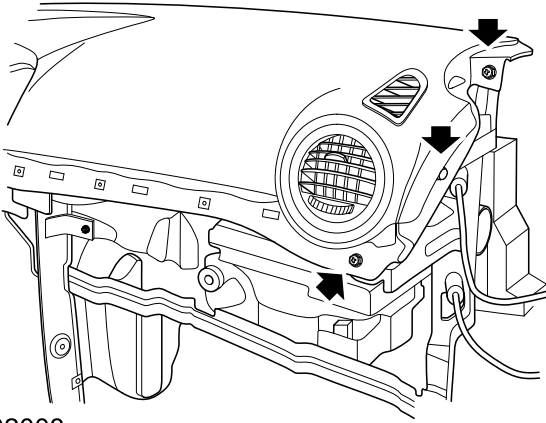
10. Remove the air conditioning control panel.

Air Conditioning Control Panel

11. Remove the lower instrument panel assembly.

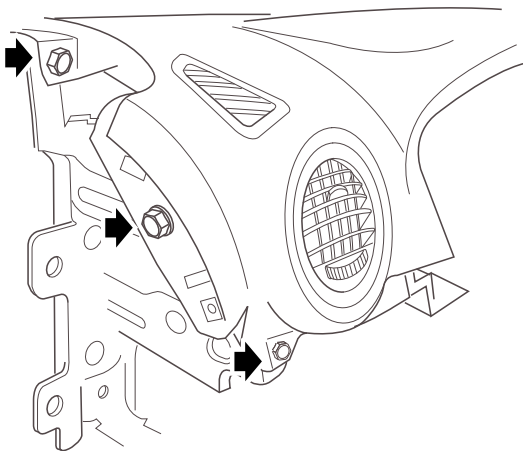
Lower Instrument Panel Assembly

12. Unscrew the 3 bolts securing the right side of the upper instrument panel assembly to the instrument panel member.

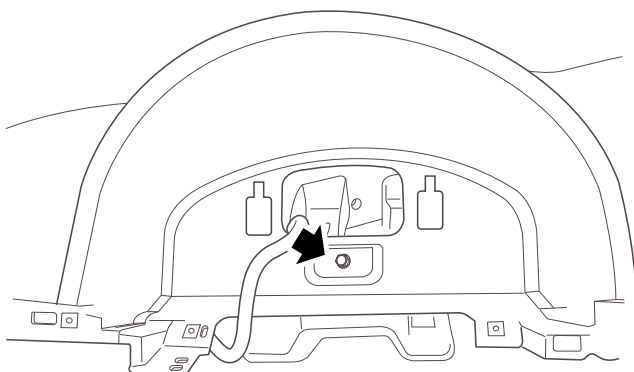


S82003

13. Unscrew the 3 bolts securing the left side of upper instrument panel assembly to the instrument panel member.

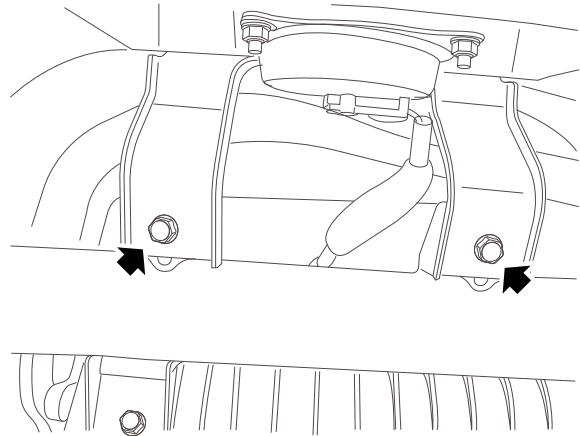


14. Unscrew a bolt securing the upper instrument panel assembly to the instrument panel member.



15. Unscrew the 2 bolts securing the upper instrument

panel assembly (passenger side airbag bracket) to the instrument panel member.



16. Disconnect the electrical connector.
17. Remove the upper instrument panel assembly.

Refit

1. Connect the electrical connector.
2. Secure the upper instrument panel assembly to the instrument panel member, then fit the bolt and tighten to **6-8 Nm**.
3. Fit the instrument pack.

Instrument Pack

4. Fit the navigation (advanced configuration)/radio (medium and low configuration).
5. Fit the centre control panel.

Centre Control Panel

6. Fit the lower instrument panel assembly.

Lower Instrument Panel Assembly

7. Fit the air conditioning control panel.

Air Conditioning Control Panel

8. Fit the glove box assembly.

Glove Box Assembly

9. Fit the instrument side panel.

Instrument Side Panel

10. Fit the steering wheel and the steering column assembly.

Steering Wheel Assembly

Steering Column Assembly

11. Fit the meter trim frame assembly and the steering column upper protector.
12. Fit the right garnish.
13. Fit the instrument panel assembly.

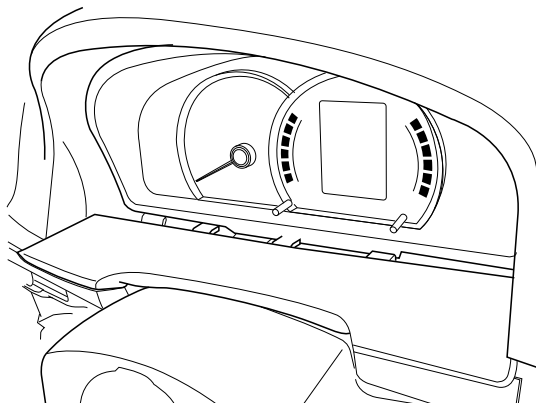
Instrument Panel Assembly

14. Connect the battery negative terminal.

Lower Instrument Panel Assembly

Removal

1. Disconnect the battery negative terminal.



S82001

2. Remove the instrument panel assembly.

Instrument Panel Assembly

3. Remove the centre control panel.

Centre Control Panel

4. Remove the meter trim frame assembly and the steering column upper protector.

5. Remove the right garnish.

Right Garnish

6. Remove the instrument side panel.

Instrument Side Panel

7. Remove the glove box assembly.

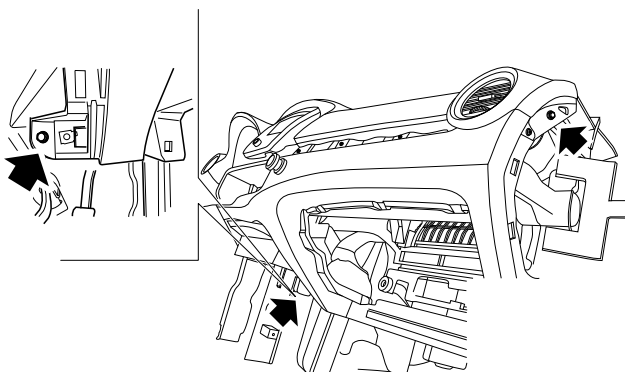
Glove Box Assembly

8. Remove the air conditioning control panel assembly.

Air Conditioning Control Panel Assembly

9. Unscrew a self-tapping screw securing the upper right end of lower instrument panel assembly to the upper instrument panel assembly.

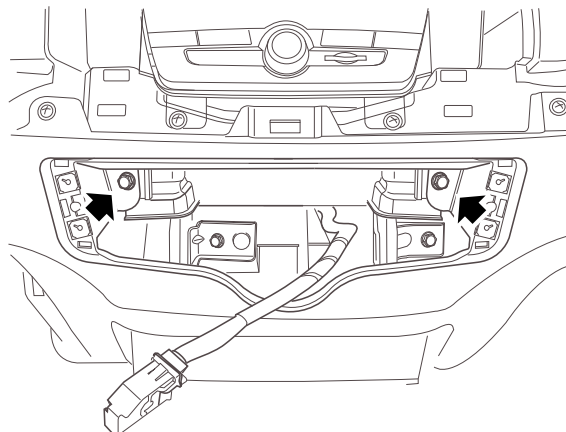
10. Unscrew a nut securing the lower left end of the lower instrument panel assembly to the instrument panel member.



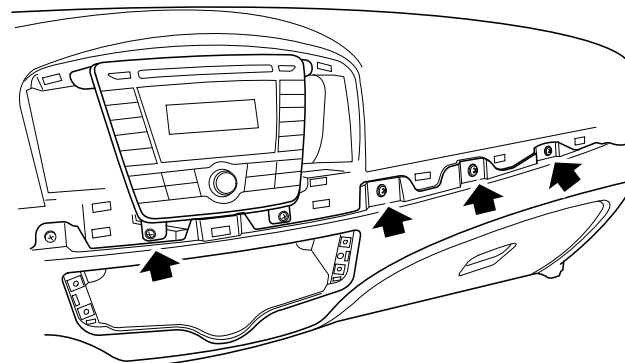
S83001

11. Unscrew the 2 screws securing the lower instrument

panel assembly to the member.



12. Unscrew the 4 self-tapping screws securing the lower instrument panel assembly to the upper instrument panel assembly.



13. Remove the lower instrument panel assembly.

Refit

1. Secure the lower instrument panel to the upper instrument panel and the instrument panel member, then fit the screw and tighten to **1.3-1.9 Nm**, fit the bolt and tighten to **6-8 Nm**, fit the nut and tighten to **1.7-2.3 Nm**.

2. Fit the glove box assembly.

Glove Box Assembly

3. Fit the air conditioning control panel assembly.

Air Conditioner Panel Assembly

4. Fit the instrument side panel.

Instrument Side Panel

5. Fit the meter trim frame assembly and the steering column upper protector.

6. Fit the right garnish.

Right Garnish

7. Fit the centre control panel.

Centre Control Panel

8. Fit the instrument panel assembly.

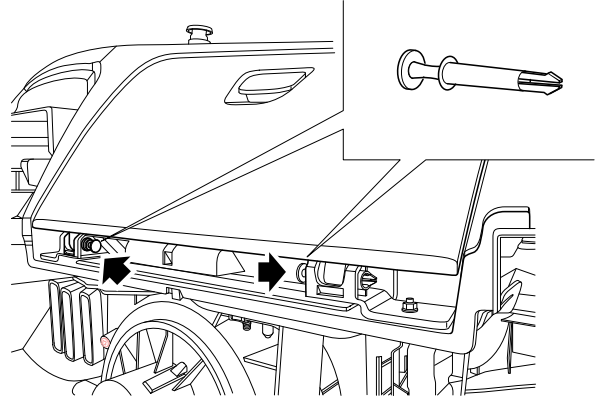
Instrument Panel Assembly

9. Connect the battery negative terminal.

Glove Box Assembly

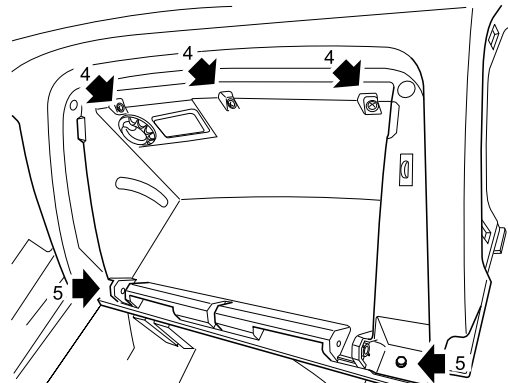
Removal

1. Disconnect the battery negative terminal.
2. Pull out the hinge pin connecting the glove box door to the glove box frame.



S84001

3. Remove the glove box door.
4. Unscrew the 3 self-tapping screws securing the glove box frame to the lower instrument panel.
5. Unscrew the 2 set bolts securing the glove box frame to the lower instrument panel.



S84002

6. Disconnect the electrical connector.
7. Remove the glove box.

Refit

1. Connect the electrical connector.
2. Secure the glove box frame to the lower instrument panel, then fit the screw and tighten to **1.3-1.9 Nm**, fit the bolt and tighten to **6-8 Nm**.
3. Fit the glove box door.
4. Secure the glove box door to the glove box frame and fit the hinge pin.
5. Fit the glove box stopper plate RH.
6. Connect the battery negative terminal.

Instrument Side Panel**Removal**

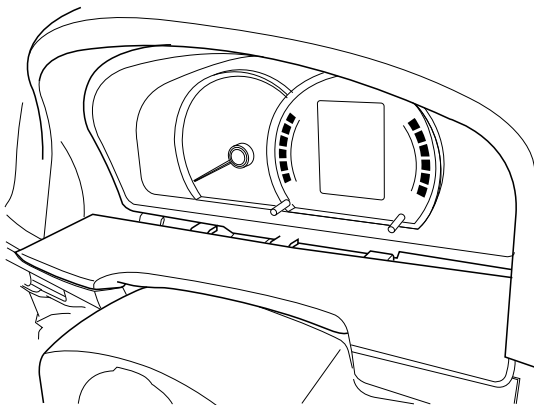
1. Disconnect the battery negative terminal.
2. Remove the instrument panel end surface cover plate LH.
3. Remove the A pillar lower trim panel LH.

 **A Pillar Lower Trim Panel**

4. Remove the A pillar upper trim panel LH.

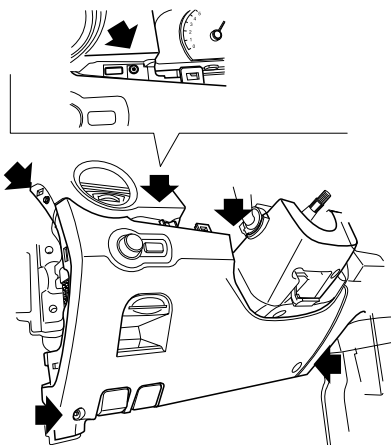
 **A Pillar Upper Trim Panel**

5. Remove the A pillar centre trim panel LH.
6. Disconnect the bonnet release cable from the engine cover opener handle.
7. Disconnect the fuel flap release cable from the fuel filler door opener handle assembly.
8. Remove the meter trim frame assembly and the steering column upper protector.



S82001

9. Remove the 5 self-tapping screws securing the instrument side panel to the upper instrument panel and the instrument panel member.



S85001

10. Disconnect the electrical connector.
11. Remove the instrument side panel.

Refit

1. Connect the electrical connector.

2. Secure the instrument side panel to the upper instrument panel and the instrument panel member, then fit the screw and tighten to **1.3-1.9 Nm**.
3. Fit the meter trim frame assembly and the steering column upper protector.
4. Disconnect the bonnet release cable from the engine cover opener handle.
5. Disconnect the fuel flap release cable from the fuel filler door opener handle assembly.
6. Fit the A pillar upper trim panel LH.

 **A Pillar Upper Trim Panel**

7. Fit the A pillar lower trim panel LH.

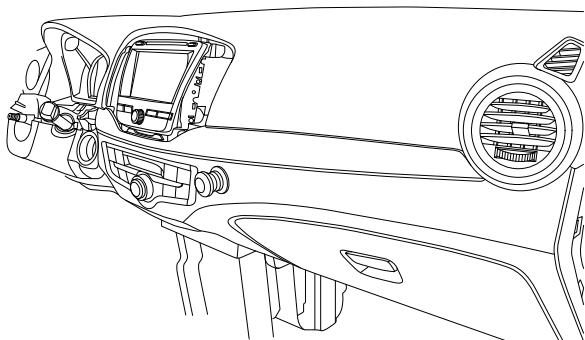
 **A Pillar Lower Trim Panel**

8. Fit the A pillar centre trim panel LH.
9. Fit the instrument panel end surface cover plate LH.
10. Fit the instrument side panel.
11. Connect the battery negative terminal.

Garnish Assembly RH

Removal

1. Remove the centre control panel.



S86001

Centre Control Panel

2. Pull out the right side of the meter trim frame assembly firstly, then remove the right garnish.

Refit

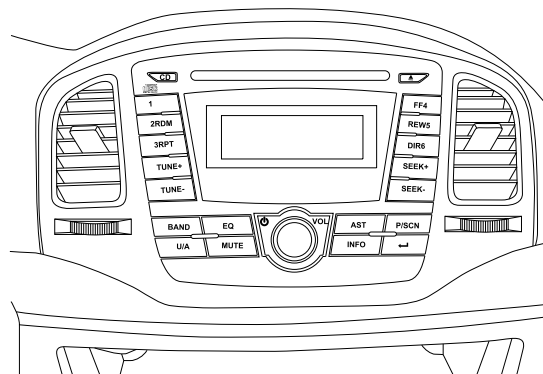
1. Fit the garnish assembly RH to the upper instrument panel.
2. Fit the centre control panel.

Centre Control Panel

Centre Control Panel

Removal

1. Pry the centre control panel off.



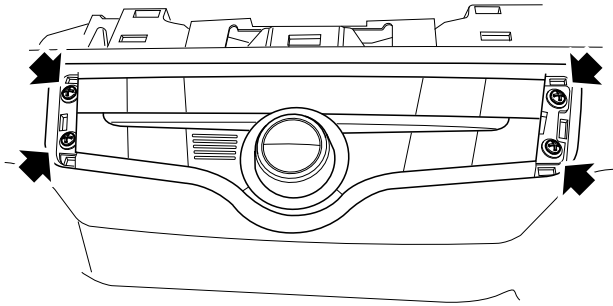
S87001

Refit

1. Fit the centre control panel.

Air Conditioning Control Panel**Removal**

1. Disconnect the battery negative terminal.
2. Remove the trim cover.
3. Unscrew the 4 self-tapping screws securing the air conditioning control panel to the lower instrument panel.



S88001

4. Disconnect the electrical connector.
5. Remove the air conditioning control panel from the lower instrument panel.

Refit

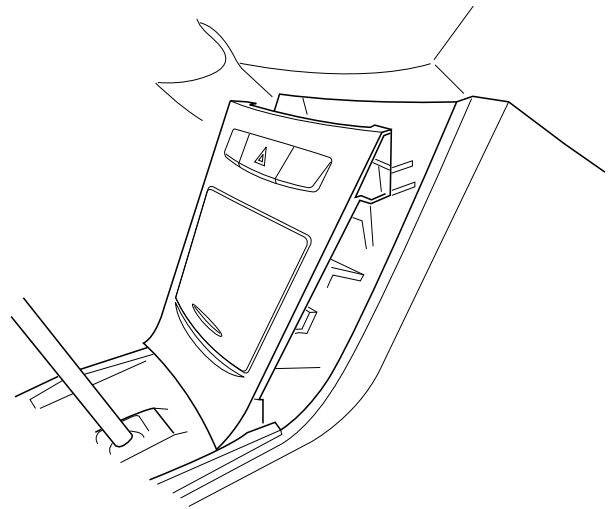
1. Connect the electrical connector.
2. Secure the air conditioning control panel to the lower instrument panel, then fit the screw and tighten to **1.3-1.9 Nm**.
3. Fit the trim cover.
4. Connect the battery negative terminal.

Centre Console**Removal**

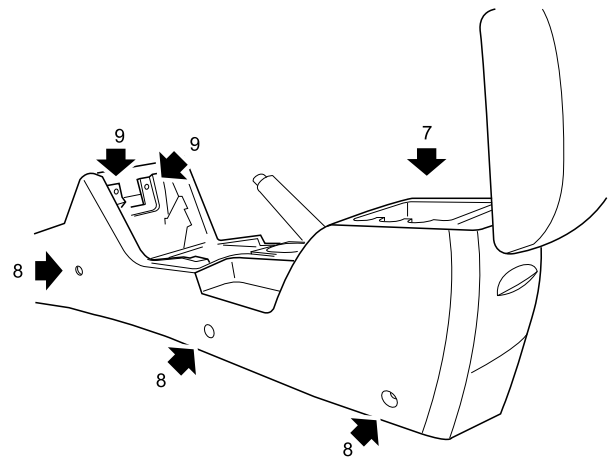
1. Disconnect the battery negative terminal.
2. Remove the front seat assembly.

 **Front Seat Assembly**

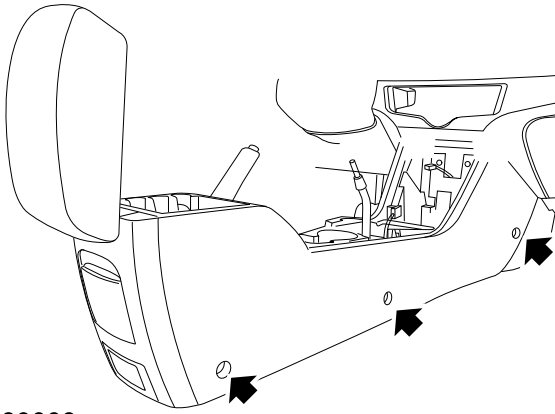
3. Remove the ball handle of the gearshift.
4. (Remove the centre console weather-strip (only for the automatic transmission)) Pry out the shift panel assembly, then disconnect the cigar lighter and remove the shift panel assembly.
5. Remove the centre console storage box.



6. Open the centre console armrest box and take out the felt.
7. Unscrew a screw securing the centre console to the rear mounting bracket.
8. Unscrew the 3 screws securing the centre console side driver side to the bracket.
9. Unscrew the 2 screws securing the front of the centre console to the lower instrument panel.

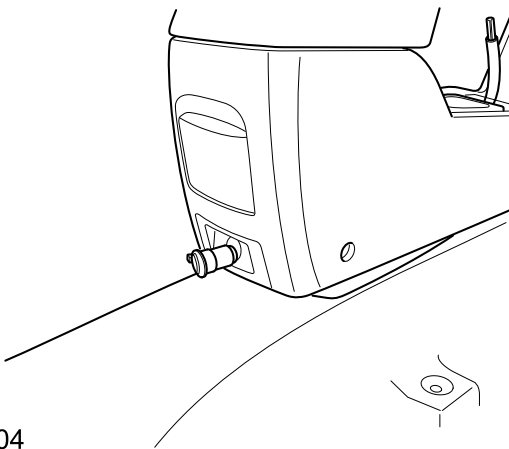


10. Unscrew the 3 screws securing the centre console side passenger side to the bracket.



S89003

11. Pull out the 12 V power source, and disconnect the electrical connector.



S89004

12. Remove the centre console.

Refit

1. Connect the wire connector and the 12 V power source.
2. Secure the front of the centre console to the lower instrument panel, then fit the bolt and tighten to **2.7-3.3 Nm**.
3. Secure the side of the centre console to the mounting bracket, then fit the bolt and tighten to **2.7-3.3 Nm**.
4. Open the centre console package tray and secure the centre console to the rear mounting bracket, then fit the bolt and tighten to **2.7-3.3 Nm**.
5. Fit the felt.
6. Fit the centre console box.
7. Connect the cigar lighter and fit the centre console shift panel assembly. (Fit the centre console weather-strip to the original position (only for the automatic transmission)).
8. Fit the ball handle of the gearshift.
9. Fit the ball handle of the gearshift.

Front Seat Assembly

10. Connect the battery negative terminal.

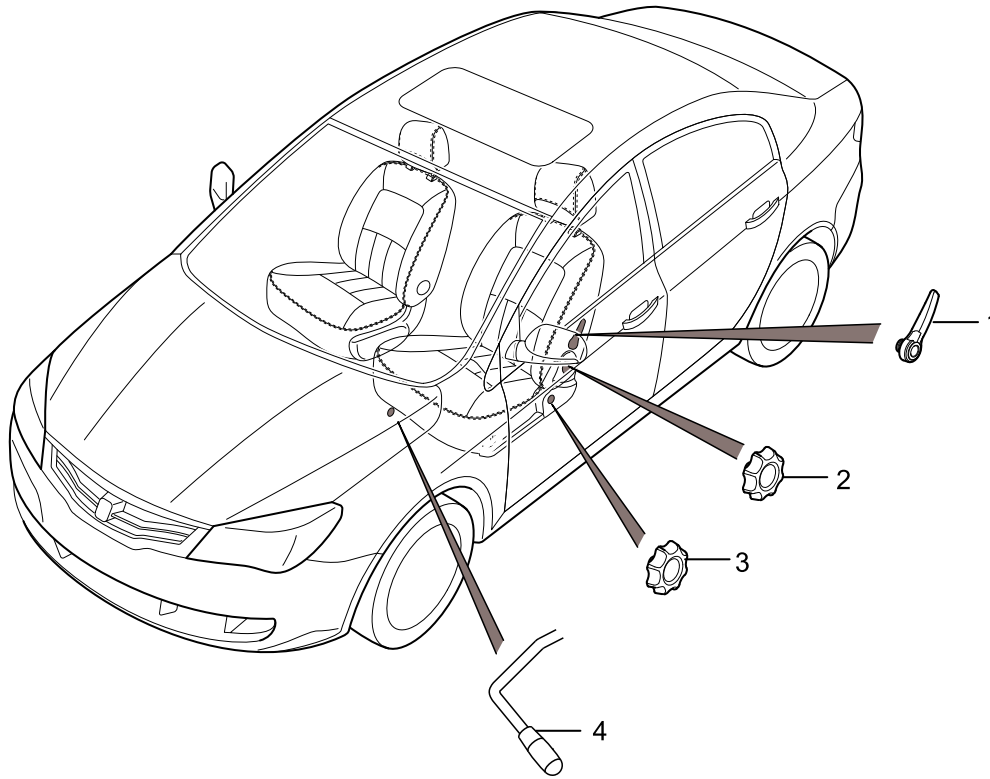
**Seats
Specifications
Torque**

| Description | Value |
|---|----------|
| Bolt - Front Seat to Body | 40-50 Nm |
| Bolt - Seatback Assembly to Seat Cushion Assembly | 40-50 Nm |
| Bolt - Striker to Body | 19-25 Nm |

Description and Operation

System Component Layout

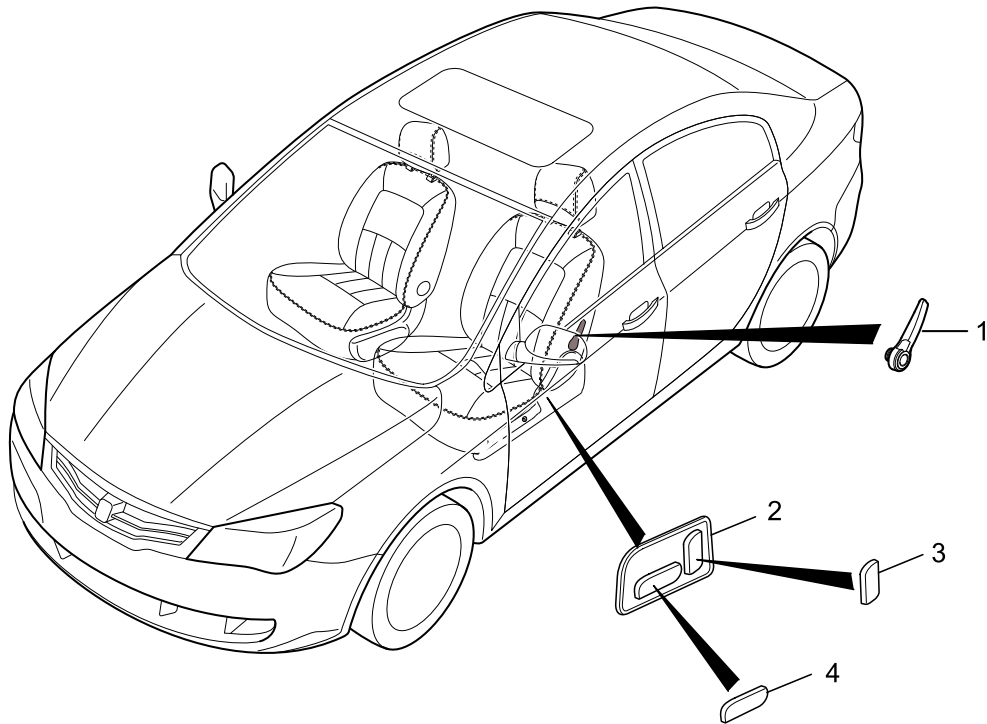
Manual Driver Seat Component Layout



S682000

- 1. Lumbar Support Adjustment Handle
- 2. Seatback Adjustment Hand Wheel
- 3. Seat Vertical Hand Wheel
- 4. Seat Fore-and-Aft Handle

Power Driver Seat Component Layout

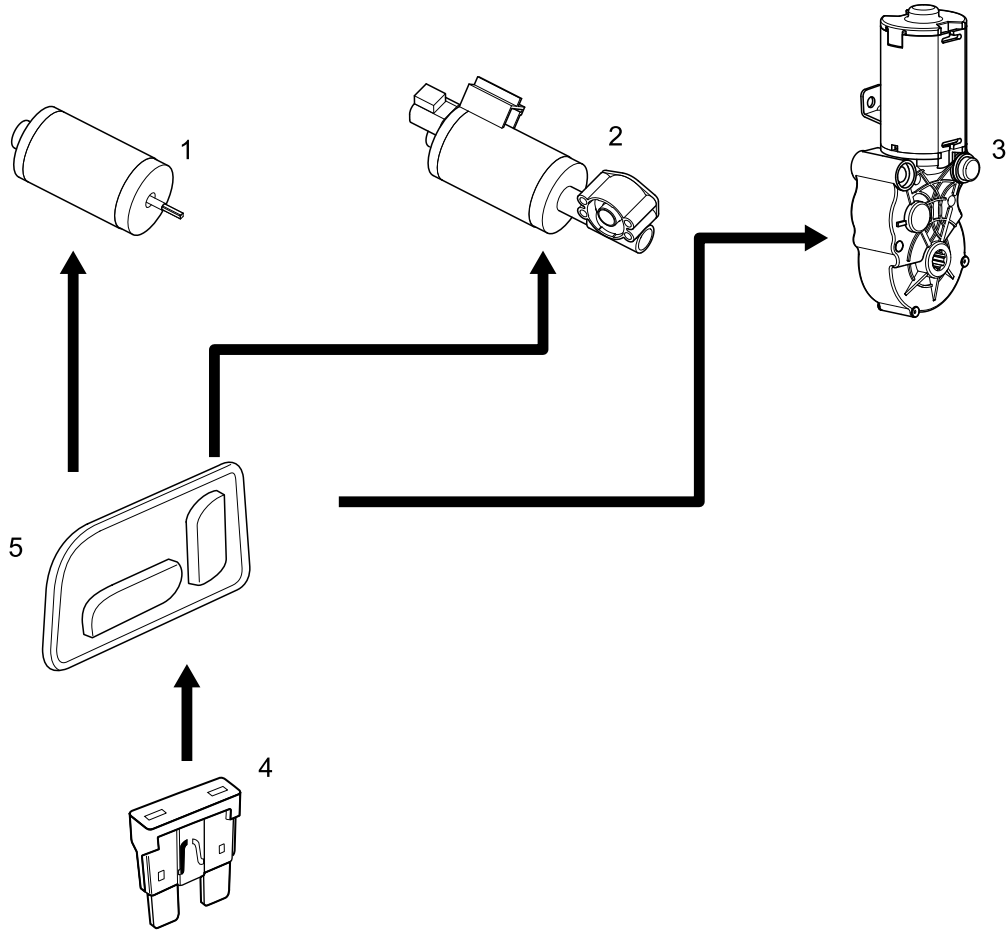


S682001

- | | |
|-------------------------------------|---|
| 1. Lumbar Support Adjustment Handle | 3. Driver Seatback Adjustment Switch |
| 2. Driver Seat Switch Set | 4. Driver Seat Vertical and Fore-and-Aft Switch |

System Control Diagram

Power Driver Seat Control Diagram



A 

A = Hard Wire

- 1. Seat Fore-and-Aft Motor
- 2. Seat Vertical Motor
- 3. Seatback Adjustment Motor

- 4. Seat Adjustment Fuse 25 (30A)
- 5. Driver Seat Switch Set

Description**Driver Seat**

Depending on the different vehicle equipment and seat exterior, the configuration of driver seat has 4 different levels as follows:

- Advanced fabric 6-way manual seat (seat position sliding forward/backward, reclining, seat height);
- Six-way manual seat with the leather (seat position sliding forward/backward, reclining, seat height and lumbar support adjustment);
- Six-way power seat with the leather (seat position sliding forward/backward, reclining, seat height and lumbar support adjustment);

- Six-way power seat with the leather and side airbag (seat position sliding forward/backward, reclining, seat height and lumbar support adjustment). In addition, the centre position of the rear seat in this model is equipped with the headrest.

Front Passenger Seat

The configurations of the front passenger seat in all models are only four-way manual adjustment (the fore-and-aft adjustment of the seat position and the reclining of the seatback). The advanced configuration model is also equipped with the seat belt unfasten reminder and the side airbag. The storage box is under the seat cushion of the passenger seat.

Operation**Manual Seat****Driver Seat**

The fore-and-aft position of the seat can be adjusted by the handle located at the front of the seat. The desired position can be reached by lifting the handle. The seat is locked in the selected position when the handle is released. The second adjustment hand wheel located at the front of the seat cushion outside trim panel is used to adjust the height of the seat. The seat height can be raised and lowered by repeatedly turning this hand wheel clockwise or counterclockwise. The third adjusting hand wheel behind the vertical adjusting hand wheel is used to adjust the inclination of the seatback. The inclination of the seatback can be adjusted by repeatedly turning this hand wheel clockwise or counterclockwise. There is a rotary handle located at the underneath of driver seatback outside for adjusting the lumbar support in the seatback. Turning the lumbar support adjusting handle clockwise could make the lumbar back cushion softer, while turning counterclockwise could make it harder. Turning this adjusting handle will pull a cable connected to the lumbar support device with the edge. With the cable being pulled, the lumbar support device deviates from the original position to make the lumbar back cushion harder.

Front Passenger Seat

The adjustment mode of passenger seat is the same as the driver seat. The seat can be adjusted forward and backward

by the handle located at the front of the seat. The adjusting hand wheel on the side can adjust the seatback position.

Power Seat

The driver power seat can be adjusted by using the driver seat switch box located at the seat outside trim panel. As a result, the personal requirement can be satisfied. This seat has the power adjustment modes, for example, moving forward/backward, the change of the height and the inclination of the seatback and so on. The lumbar support adjustment is always controlled by hand. The seat can be adjusted when the wireless key is turned to **AUX** or ignition position. The power is supplied to the power seat through the fuse 25 (30 **A**) in the engine bay. The axial movement of the seat can be controlled by the driver seat switch box located at the seat outside trim panel. This switch box has a two-way switch which controls the fore-and-aft tilt of the seatback and a four-way switch which controls the seat height and fore-and-aft position of the seat. Each motor is powered by the 12V power source from the switch box and grounds. Depending on the different adjustment requirements of the seat, the power is supplied to the selected motor and makes it operate. When the seat reaches its maximum adjustment position in each adjustment direction, the thermal protection cut switch will cut the power supply automatically to protect the motor.

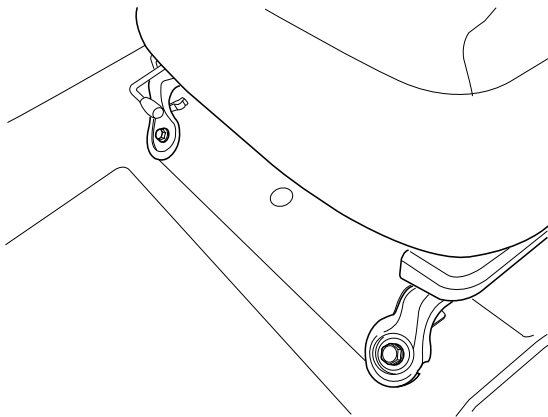
Service Procedures

Front Seat

Warning: Before starting removing and repairing the SRS system, always remove the key from the ignition switch and disconnect the vehicle battery for more than 10 minutes.

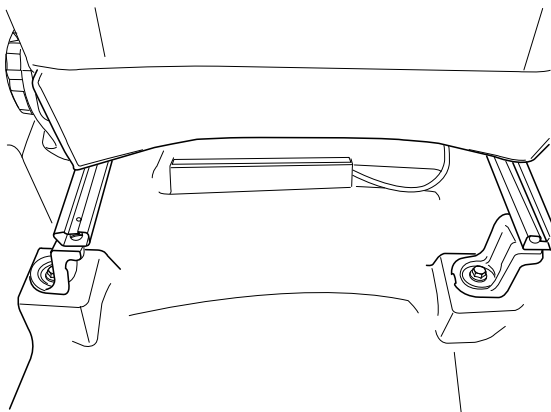
Removal

1. If the seat can be adjusted, raise it upward sufficiently.
2. Move the seat backward sufficiently.
3. Unscrew the 2 bolts securing the front of the seat to the body and dispose the bolts.



S820001

4. Move the seat forward sufficiently.
5. Unscrew the 2 bolts securing the rear of the seat to the body and dispose the bolts.



S820002

6. Disconnect the battery negative terminal.
7. Loosen the seat wire connector from the seat.
8. Disconnect the seat belt pretensioner connector.
9. Move the seat away from the vehicle.

Refit

1. Place the front seat on its mounting position.
2. Connect the seat belt pretensioner connector and the seat wire connector.

Warning: Always ensure that the SRS wire harness is arranged correctly. Be careful to avoid trapping or pinching the SRS wire harness. DO NOT hang the connector loosely or keep the SRS components hanging down by the wire harness. Check for the points that are easy worn.

3. Connect the battery negative terminal.
4. Secure the seat to the body, then fit the 2 new rear retaining bolts and tighten to **40-50 Nm**.
5. Move the seat backward sufficiently.
6. Fit the 2 new front retaining bolts and tighten to **40-50 Nm**.

Front Seatback

Removal

1. Remove the front seat belt buckle.

Front Seat Belt Buckle

2. Loosen the set screw of the inside trim panel, then remove the inside trim panel.
3. Remove the driver seat outside trim panel.

Driver Seat Outside Trim Panel

4. Loosen the cable and the J-clip securing the seatback fascia to the seat frame.
5. Unscrew the 4 bolts connecting the seat cushion assembly to the seatback assembly.
6. Disconnect the 2 seat heater connectors. (If equipped)
7. Remove the seatback assembly.

Refit

1. Position the seatback and connect the seat heater connector. (If equipped)
2. Position the seat cushion assembly and the seatback assembly, fit the 4 bolts and tighten to **40-50 Nm**.
3. Secure the seatback fascia to the seat frame with the cable and J-clip.
4. Fit the outside trim panel.

Driver Seat Outside Trim Panel

5. Position the inside trim panel, then fit the set screw and tighten it.
6. Fit the front seat belt buckle.

Front Seat Belt Buckle

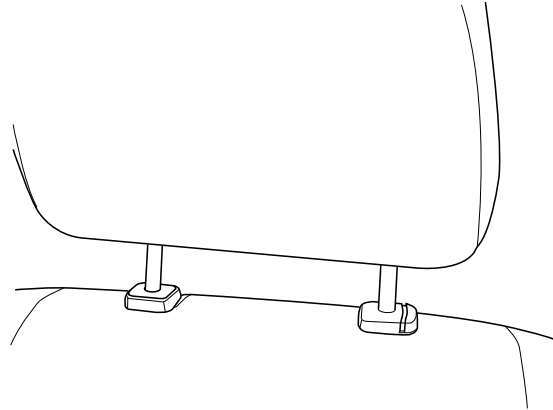
Front Seatback Cover

Removal

1. Remove the front seatback assembly.

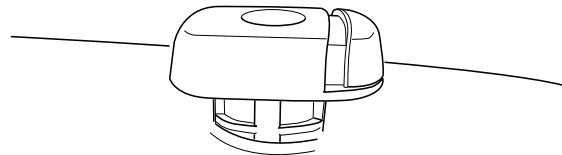
Front Seatback Assembly

2. Pull the headrest up to the uppermost place, then release the snap fit fixing the headrest and remove the headrest.



S820003

3. Remove the 2 headrest guides.



S820004

4. Driver seat: remove the lumbar support handle.
5. Loosen the seatback fascia J-clip located on the seat lower end.
6. Pull the fascia upward and unfold the C-ring connecting the seatback foam to the inside of the fascia, then note and mark their precise position.
7. Remove the fascia.

Refit

1. Position the fascia to the seatback and set the inside of the fascia to the position marked on the seatback foam with the C-ring.
2. Close the seatback fascia J-clip located on the seat lower end.
3. Driver seat: fit the lumbar support handle.
4. Fit the 2 headrest guides.
5. Position and fit the headrest.

6. Fit the front seatback assembly.

 **Front Seatback Assembly****Front Seat Cushion****Removal**

1. Remove the front seat belt buckle.

 **Front Seat Belt Buckle**

2. Remove the outside trim panel.

 **Driver Seat Outside Trim Panel**

3. Loosen the cable and the J-clip securing the seatback fascia to the seat frame.
4. Unscrew the 4 bolts connecting the seat cushion assembly to the seatback assembly.
5. Disconnect the 2 seat heater connectors. (If equipped)
6. Remove the seat cushion assembly.

Refit

1. Position the seat cushion and connect the seat heater connector. (If equipped)
2. Fit the 4 bolts connecting the seat cushion assembly to the seatback assembly and tighten to **40-50 Nm**.
3. Secure the seatback fascia to the seat frame with the cable and C-ring.
4. Fit the outside trim panel.

 **Driver Seat Outside Trim Panel**

5. Fit the front seat belt buckle.

 **Front Seat Belt Buckle**

Front Seat Cushion Cover

Removal

1. Remove the front seat cushion assembly.

Front Seat Cushion

2. Remove the J-clip and C-ring securing the seat cushion fascia to the seat frame.
3. Unfold the C-ring connecting the seat cushion foam to the inside of the fascia, then note and mark their precise position.
4. Remove the fascia from the seat cushion.

Refit

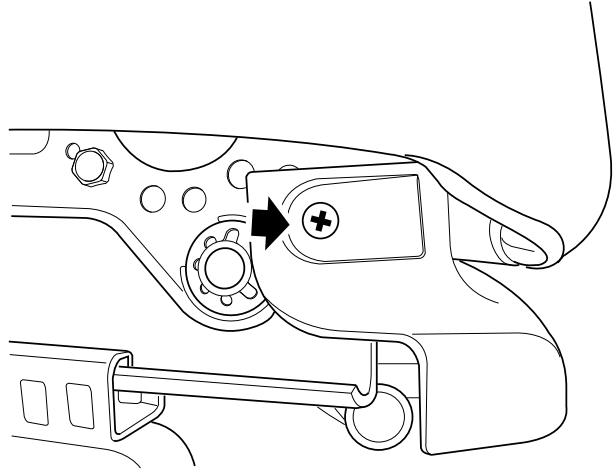
1. Position the fascia to the seat cushion, and set the inside of the fascia to the position marked on the seat cushion foam with the C-ring.
2. Secure the seat cushion fascia to the seat frame with the J-clip and the C-ring.
3. Fit the front seat cushion assembly.

Front Seat Cushion

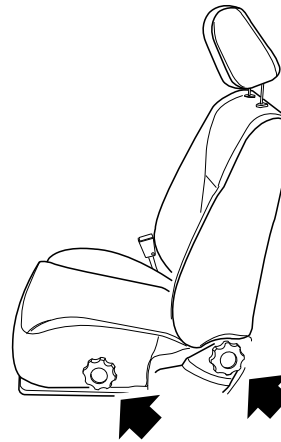
Driver Seat Outside Trim Panel

Removal

1. Tilt the seatback sufficiently.
2. Loosen the set screw on the front trim panel, and remove the front trim panel.

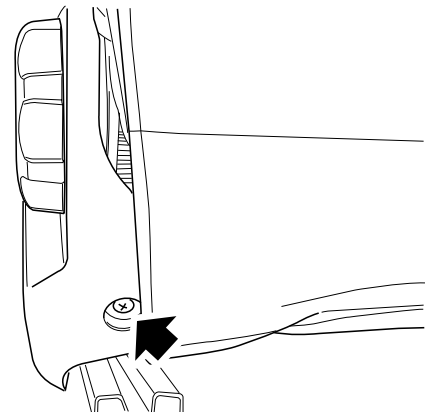


3. Manual driver seat: remove the seatback adjustment hand wheel.



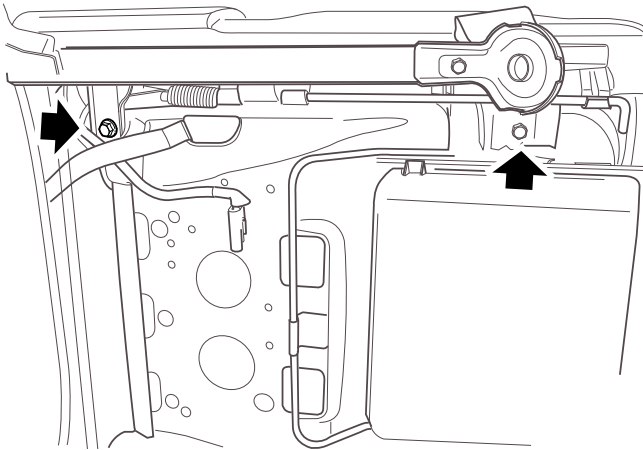
S820006

4. Remove the set screw on the outside trim panel rear end.

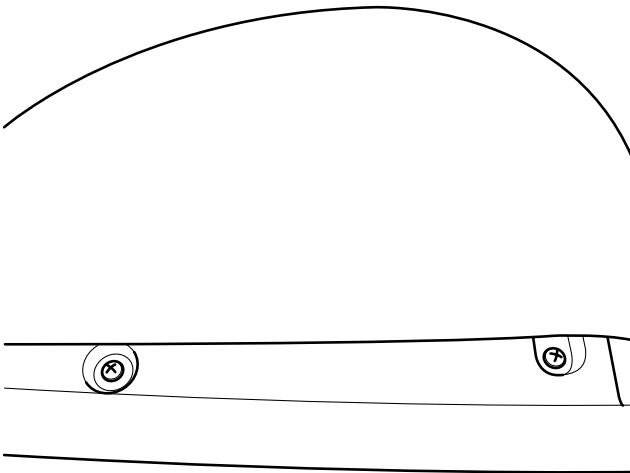


S820007

5. Loosen the 2 nuts on the back of the seat cushion frame, then loosen the seat cushion cover and the foam assembly.



- Loosen the 2 set screws on the side of the trim panel, then remove the driver seat outside trim panel.



Refit

- Position the outside trim panel, then fit the 3 set screws and tighten them.
- Position the front trim panel, then fit a set screw and tighten it.
- Manual driver seat: fit the seatback adjustment hand wheel.
- Lift up the seatback.

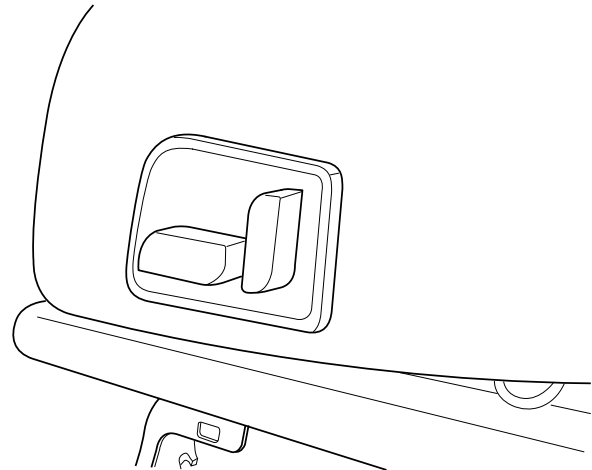
Front Power Seat Switch Set

Removal

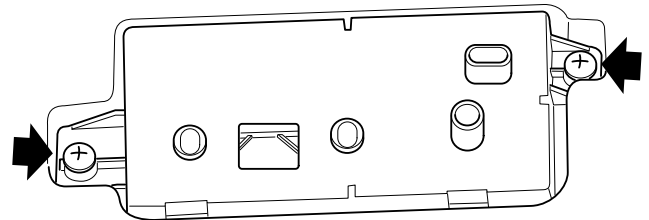
- Remove the driver seat outside trim panel assembly.

Driver Seat Outside Trim Panel

- Unscrew the screw securing the outside trim panel to the seat.



- Release the 2 adjustment switch buttons and remove the switch panel.
- Unscrew the 2 screws securing the combination switch to the outside panel and remove the combination switch.



- Disconnect the connector of the combination switch, and remove the combination switch.

Refit

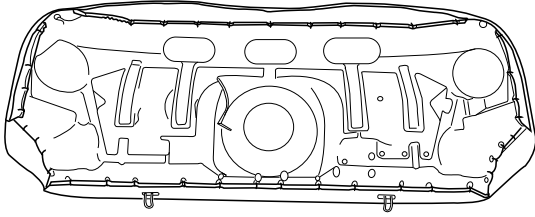
- Fit the combination switch to the outside panel and secure it with the screw.
- Connect the combination switch connector.
- Fit the adjustment switch button and the panel to the combination switch.
- Fit the driver seat outside trim panel assembly.

Driver Seat Outside Trim Panel

Rear Seat Cushion

Removal

1. Release the seat belt buckle from the seat belt through the hole.
2. Pull the front of the seat cushion upward until it is released from the steel wire bayonet.



S820008

3. After the front of the seat cushion is lifted, push the seat cushion backward and lift it until the seat cushion is released from the 2 bushings.

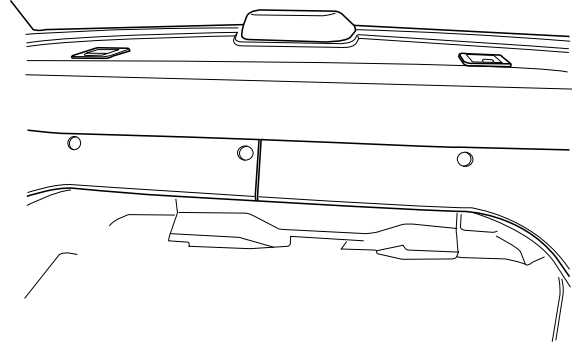
Refit

1. Make sure that the belt is on the correct route and the position of the seat cushion is correct.
2. Place the rear of the seat cushion into the 2 bushings on the body.
3. Fit the front seat cushion into the steel wire snap fit.
4. Draw out the seat belt buckle from the seat belt through hole on the seat cushion.

Rear Seatback Hinge

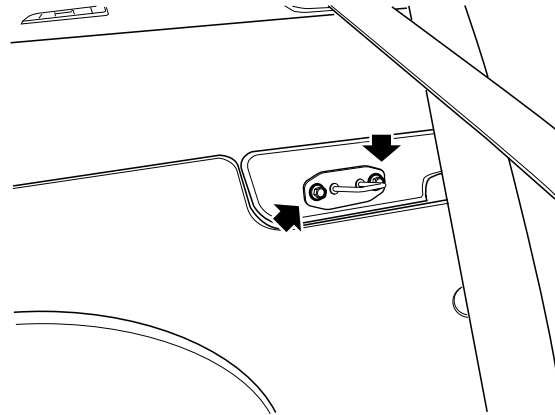
Removal

1. Loosen the rear seatback lock handle and fold down the seatback assembly.
2. Remove the trim panel from the striker.



S820009

3. Mark the position of the seatback hinge shackle.
4. Unscrew the 2 bolts securing the hinge to the body.



S820010

Refit

1. Position the hinge on the body, then fit the bolt and tighten to **19-25 Nm**.
2. Fit the trim panel to the body.
3. Close the rear seatback assembly.

**Door Trim
Specifications
Torque**

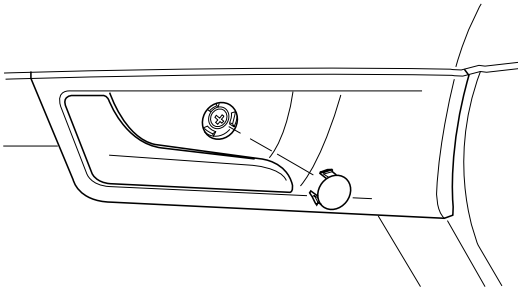
| Description | Value |
|--|------------|
| Self-Tapping Screw - Front Door Trim Panel | 1.5-2 Nm |
| Bolt - Roof Inner Handle | 2-3 Nm |
| Bolt - Driver Side Glasses Box | 2-3 Nm |
| Bolt - A Pillar Upper Trim Panel | 1.5-1.7 Nm |
| Bolt - A Pillar Lower Trim Panel | 1.5-1.7 Nm |
| Bolt - B Pillar Upper Trim Panel | 1.5-1.7 Nm |
| Bolt - Front Seat Belt Anchor of B Pillar Upper Part | 35-45 Nm |
| Bolt - B Pillar Lower Trim Panel | 1.5-1.7 Nm |
| Bolt - Front Seat Belt Anchor of B Pillar Lower Part | 35-45 Nm |
| Bolt - C Pillar Trim Panel | 1.5-1.7 Nm |
| Bolt - Seat Belt to Body | 45-55 Nm |
| Bolt - Boot Door Sill Trim Panel to Body | 1.5-1.7 Nm |
| Bolt - Door Sill Trim Panel | 1.5-1.7 Nm |
| Bolt - Sun Visor Bracket | 4-6 Nm |
| Bolt - Sun Visor | 4-6 Nm |

Service Procedures

Front Door Inner Garnish

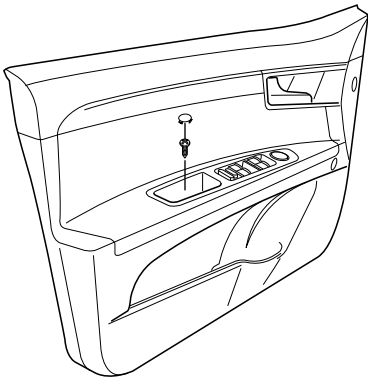
Removal

1. Disconnect the battery earth lead.
2. Remove the outer rear view mirror inner garnish.
3. Move the inner handle trim cover away and remove the door inner handle set screw.



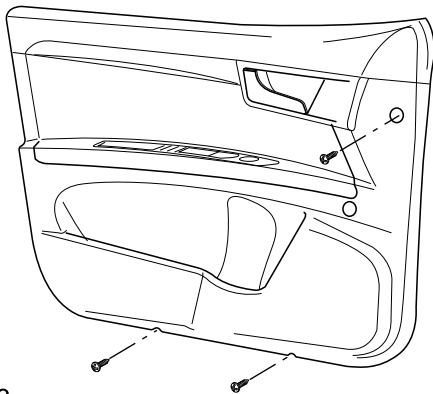
S83001

4. Move the window switch trim cover away and remove the window switch set screw.



S83002

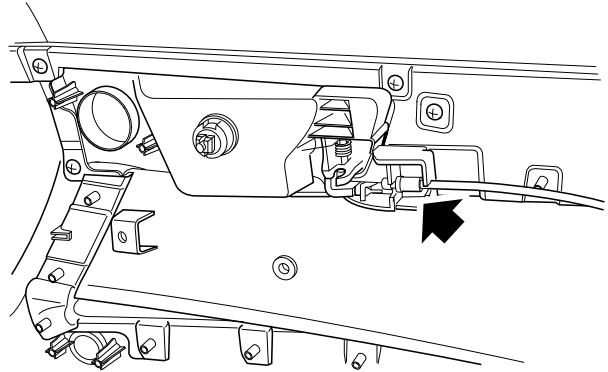
5. Remove the 3 set screws securing the inner garnish.



S83003

6. Loosen the 6 snap fits securing the door garnish to the door carefully.

7. Disconnect the connectors of the tweeter, the boot opener switch and the door switch.
8. Loosen the inner handle door lock cable.



S83004

9. Remove the front door inner garnish.

Refit

1. Connect the electrical connector.
2. Fit the door lock cable.
3. Fit the front door inner garnish to the front door.
4. Fit the 5 set self-tapping screws on the inner garnish, and the torque is **1.5-2 Nm**.
5. Connect the battery earth lead.

Front Door Waterproof Film

Removal

1. Remove the front door inner garnish.

 **Front Door Inner Garnish**

2. Remove the front door waterproof film from the door panel.

Refit

1. Apply the glue to the applicable location on the door panel.
2. Affix the waterproof film.
3. Fit the front door inner garnish.

 **Front Door Inner Garnish**

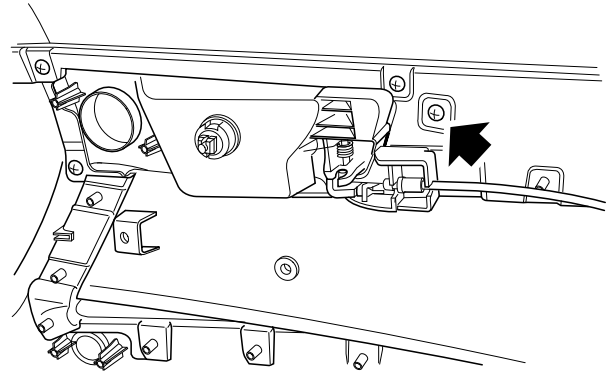
Front Door Inner Handle

Removal

1. Remove the front door inner garnish.

 **Front Door Inner Garnish**

2. Remove the 5 screws securing the inner handle to the door inner garnish.



3. Remove the 2 screws securing the boot opener switch to the door inner garnish.
4. Remove the front door inner handle.

Refit

1. Fit the front door inner handle to the garnish and tighten the 5 mounting bolts.
2. Fit the boot opener switch to the garnish, then fit the 2 screws and tighten them.
3. Fit the front door garnish.

 **Front Door Inner Garnish**

Rear Door Inner Garnish**Removal**

1. Disconnect the battery earth lead.
2. Move the inner handle trim cover away and remove the door inner handle set screw.
3. Move the window switch trim cover away and remove the window switch set screw.
4. Remove the 2 set screws securing the inner garnish.
5. Loosen the 4 snap fits securing the door garnish to the door carefully.
6. Disconnect the electrical connector.
7. Loosen the inner handle door lock cable.
8. Remove the rear door inner garnish.

Refit

1. Connect the electrical connector.
2. Fit the door lock cable.
3. Fit the rear door inner garnish to the rear door.
4. Fit the 3 set screws on the inner garnish, and the torque is **1.5-2 Nm**.
5. Connect the battery earth lead.

Rear Door Waterproof Film**Removal**

1. Remove the rear door inner garnish.

**Rear Door Inner Garnish**

2. Remove the rear door waterproof film from the door panel.

Refit

1. Apply the glue to the applicable location on the door panel.
2. Apply the waterproof film.
3. Fit the rear door inner garnish.

**Rear Door Inner Garnish**

Rear Door Inner Handle**Removal**

1. Remove the rear door inner garnish.

 **Rear Door Inner Garnish**

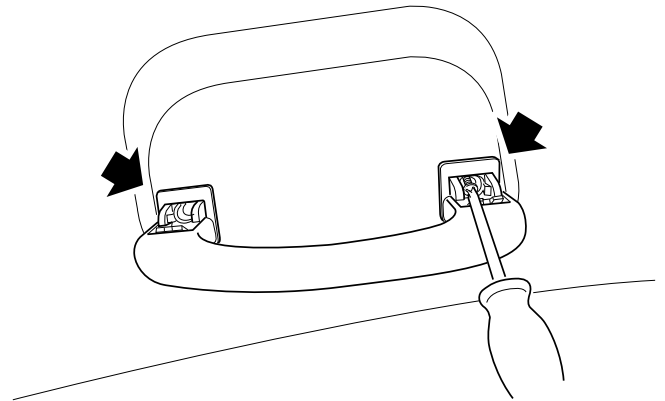
2. Remove the screw of the rear door inner handle.
3. Remove the rear door inner handle.

Refit

1. Fit the front door inner handle to the garnish.
2. Fit the screw of the rear door inner handle.
3. Fit the rear door inner garnish.

 **Rear Door Inner Garnish****Roof Inner Handle****Removal**

1. Open the trim cover to expose the roof inner handle bolt.
2. Unscrew the 2 bolts securing the roof inner handle to the ceiling.

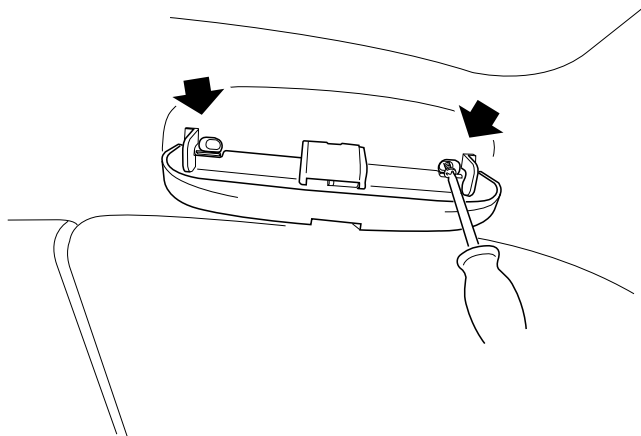
**Refit**

1. Secure the roof inner handle to the ceiling, then fit the bolt and tighten to **2-3 Nm**.

Driver Side Glasses Box

Removal

1. Open the glasses box and the trim cover inside to expose the bolt securing the glasses box.
2. Unscrew the 2 bolts securing the glasses box to the ceiling.



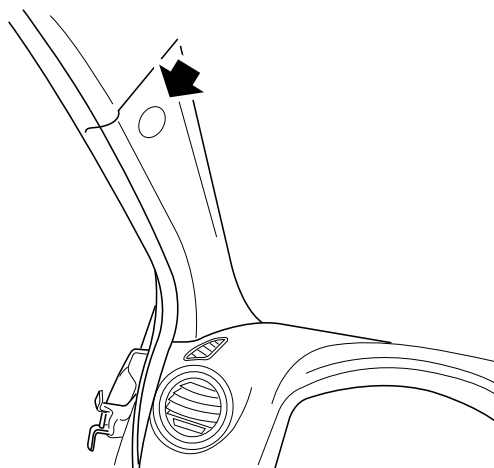
Refit

1. Secure the glasses box to the ceiling, then fit the bolts and tighten to **2-3 Nm**.

A Pillar Upper Trim Panel

Removal

1. Remove the front door weatherstrip.
2. Pry out the A pillar upper trim panel upper trim cover.
3. Unscrew a bolt securing the A pillar upper trim panel to the body.




Refit

1. Secure the A pillar upper trim panel to the body, then fit the bolt and tighten to **1.5-1.7 Nm**.
2. Fit the trim cover on the A pillar upper trim panel.
3. Fit the front door weatherstrip.

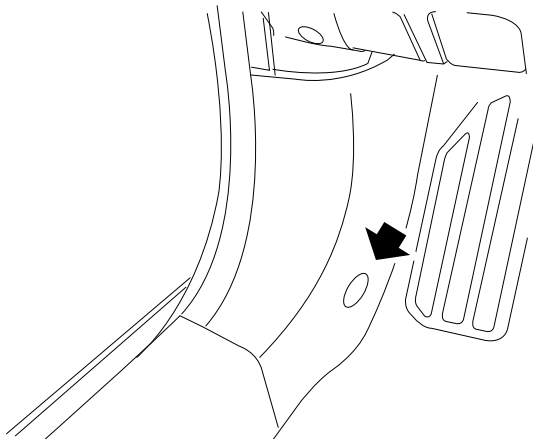
A Pillar Lower Trim Panel

Removal

1. Remove the front door sill trim panel.

 **Front Door Sill Trim Panel**

2. Remove the front door weatherstrip.
3. Remove the trim cover on the A pillar lower trim panel.
4. Unscrew the 2 bolts securing the A pillar lower trim panel to the body, then move the A pillar lower trim panel away.



Refit

1. Secure the A pillar lower trim panel to the body, then fit the bolts and tighten to **1.5-1.7 Nm**.
2. Fit the trim cover.
3. Fit the front door sill trim panel.

 **Front Door Sill Trim Panel**

4. Fit the front door weatherstrip.

B Pillar Upper Trim Panel

Removal

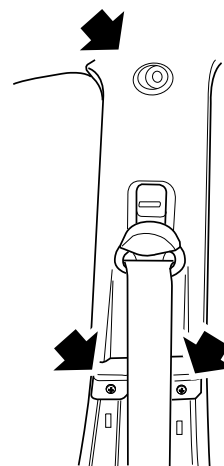
1. Remove the B pillar lower trim panel.

 **B Pillar Lower Trim Panel**

2. Loosen a bolt securing the front seat belt upper anchorage.

 **Front Seat Belt Assembly**

3. Remove the B pillar upper trim panel trim cover.
4. Unscrew the 2 self-tapping screws and a screw securing the B pillar upper trim panel to the body.



5. Remove the B pillar upper trim panel.

Refit

1. Secure the B pillar upper trim panel to the body, then fit the screw and tighten to **1.5-1.7 Nm**.
2. Fit the B pillar upper trim panel trim cover.
3. Fit the front seat belt upper anchorage with the bolt, and the torque is **35-45 Nm**.

 **Front Seat Belt Assembly**


4. Fit the B pillar lower trim panel.

 **B Pillar Lower Trim Panel**

B Pillar Lower Trim Panel

Removal

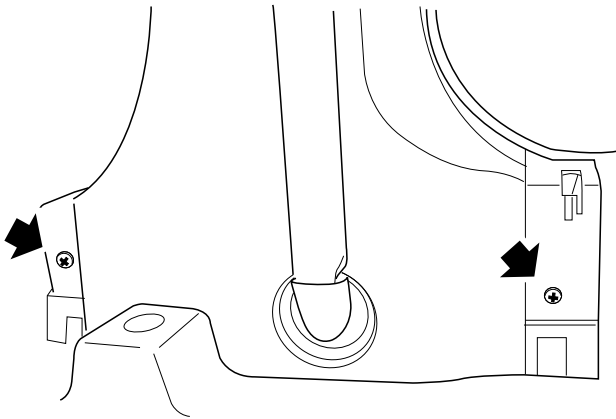
1. Remove the front door sill trim panel.

 **Front Door Sill Trim Panel**

2. Remove the front door weatherstrip.
3. Remove the rear door sill trim panel.

 **Rear Door Sill Trim Panel**


4. Remove the rear door weatherstrip.
5. Loosen a bolt securing the front seat belt to the B pillar lower trim panel.
6. Unscrew the 2 bolts securing the B pillar lower trim panel to the body.



7. Remove the B pillar lower trim panel.

Refit

1. Secure the B pillar lower trim panel to the body, then fit the bolts and tighten to **1.5-1.7 Nm**.
2. Fit the front seat belt lower anchorage with the bolt, the torque is **35-45 Nm**.
3. Fit the front door sill trim panel.

 **Front Door Sill Trim Panel**

4. Fit the front door weatherstrip.
5. Fit the rear door sill trim panel.

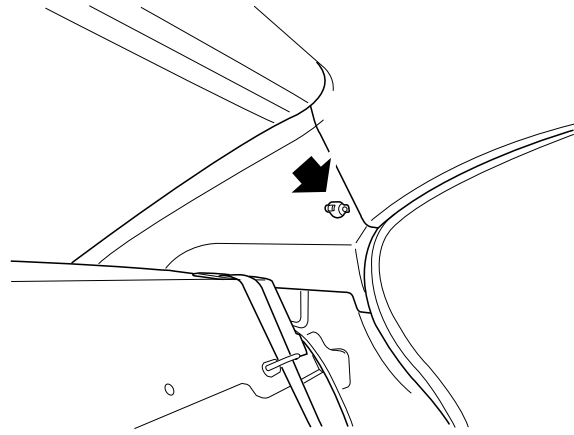
 **Rear Door Sill Trim Panel**

6. Fit the rear door weatherstrip.

C Pillar Trim Panel

Removal

1. Remove the rear door weatherstrip.
2. Pry the C pillar trim panel trim cover off.
3. Unscrew a bolt securing the C pillar trim panel to the body.



4. Remove the C pillar trim panel.

Refit

1. Secure the C pillar trim panel to the body, then fit the bolt and tighten to **1.5-1.7 Nm**.
2. Fit the C pillar trim panel trim cover.
3. Fit the rear door weatherstrip.

Rear Parcel Shelf

Removal

1. Disconnect the battery negative terminal.
2. Remove the rear seatback.
3. Remove the C pillar trim panel.

 **C Pillar Trim Panel**

4. Loosen the bolt securing the seat belt to the body.

 **Rear Seat Belt Assembly**

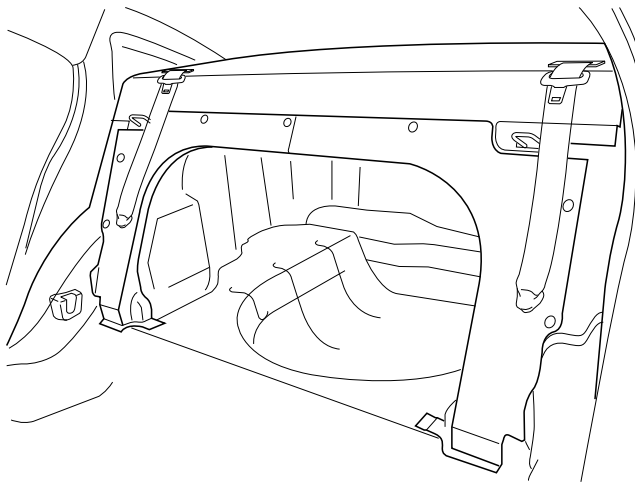
5. Remove the high mounted stop lamp.

 **High Mounted Stop Lamp**

6. Open the ISOFIX cover on the child seat upper part, then remove the original bolt of ISOFIX bracket on the child seat upper part from the parcel shelf on the corresponding white body position.

 **Child Restraint System**

7. Remove the 5 cedar-type snap fits securing the parcel shelf assembly to the body.
8. Pry the parcel shelf assembly off.



Refit

1. Fit the parcel shelf assembly into the body.
2. Secure the parcel shelf assembly to the body with the 5 cedar-type snap fits.
3. Fit the seat belt trim cover.
4. Fit the child ISOFIX cover assembly.

 **Child Restraint System**

5. Fit the high mounted stop lamp.

 **High Mounted Stop Lamp**

6. Secure the seat belt to the body with the bolt, and the torque is **45-55 Nm**.

7. Fit the C pillar trim panel.

 **C Pillar Trim Panel**

8. Fit the rear seat cushion.

 **Rear Seat Cushion**

9. Connect the battery negative terminal.

Floor Carpet

Removal

1. Disconnect the battery negative terminal.
2. Remove the rear seat cushion.

 **Rear Seat Cushion**

3. Remove the front door sill trim panel.

 **Front Door Sill Trim Panel**

4. Remove the front door weatherstrip.
5. Remove the rear door sill trim panel.

 **Rear Door Sill Trim Panel**

6. Remove the rear door weatherstrip.
7. Remove the B pillar lower trim panel LH and RH.

 **B Pillar Lower Trim Panel**

8. Remove the A pillar lower trim panel LH and RH.

 **A Pillar Lower Trim Panel**

9. Remove the front seat.

 **Front Seat**

10. Move the centre console switch and the upper trim panel of the console box away.
11. Remove the centre console.

 **Centre Console**

12. Remove the floor carpet.
13. Remove the off-dolly of the main floor carpet.

Refit

1. Fit the off-dolly of the main floor carpet.
2. Place the floor carpet into the vehicle.
3. Fit the floor centre console.

 **Centre Console**

4. Fit the upper trim panel and centre console switch of the console box.
5. Fit the front seat.

 **Front Seat**

6. Fit the A pillar lower trim panel LH and RH.

 **A Pillar Lower Trim Panel**

7. Fit the B pillar lower trim panel LH and RH.

 **B Pillar Lower Trim Panel**

8. Fit the front door weatherstrip.
9. Fit the front door sill trim panel.

 **Front Door Sill Trim Panel**

10. Fit the rear door weatherstrip.
11. Fit the rear door sill trim panel.

 **Rear Door Sill Trim Panel**

12. Fit the rear seat cushion.

Rear Seat Cushion

13. Connect the battery negative terminal.

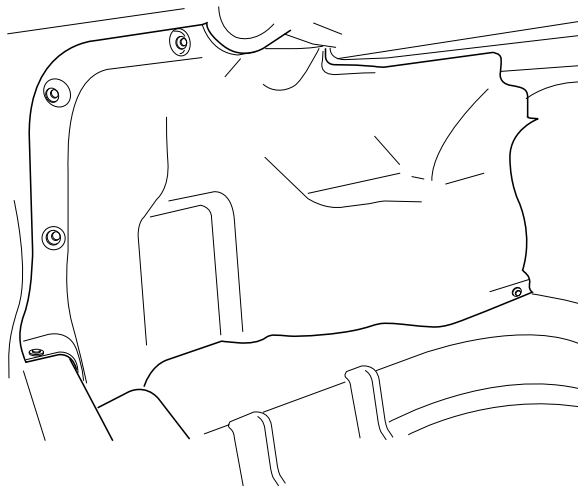
Boot Side Trim Panel

Removal

1. Open the trunklid.
2. Take the boot floor mat out.
3. Take the boot storage box out (if necessary).
4. Remove the boot door sill trim panel.

Boot Door Sill Trim Panel

5. Remove the boot weatherstrip.
6. Remove the boot side trim panel, fold and take it out.



Refit

1. Fold and place the boot side trim panel to fit it.
2. Fit the boot weatherstrip to make sure that the area around the boot seals completely.
3. Fit the boot door sill trim panel.

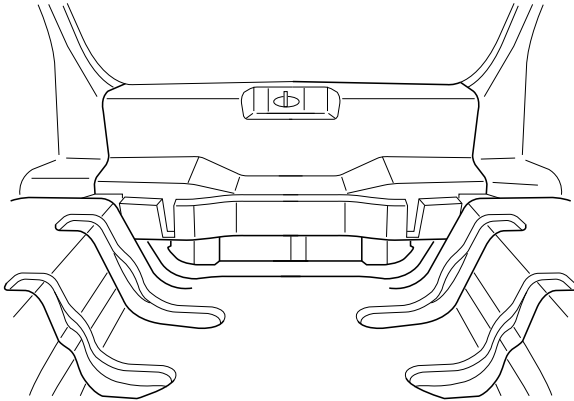
Boot Door Sill Trim Panel

4. Fit the boot storage box.
5. Place the boot floor mat.
6. Close the trunklid.

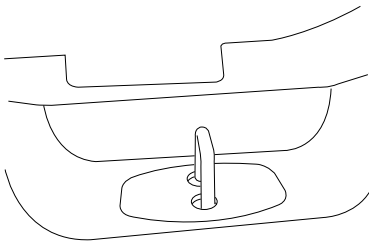
Boot Door Sill Trim Panel

Removal

1. Open the trunklid.
2. Take the boot floor mat out.
3. Remove the screw securing the boot door sill trim panel to the body.



4. Remove the boot striker trim cover.



5. Pull the boot door sill trim panel upward from the lower end by hand, then push it out toward the cabin.

Refit

1. Fit the boot door sill trim panel, and the torque is **1.5-1.7 Nm**.
2. Fit the boot striker trim cover.
3. Fit the boot floor mat.
4. Close the trunklid.

Roof Interior

Removal

1. Disconnect the battery negative terminal.
2. Remove the front door sill trim panel.

 **Front Door Sill Trim Panel**

3. Remove the rear door sill trim panel.

 **Rear Door Sill Trim Panel**

4. Remove the A pillar upper trim panel.

 **A Pillar Upper Trim Panel**

5. Remove the B pillar upper trim panel.

 **B Pillar Upper Trim Panel**

6. Remove the C pillar trim panel.

 **C Pillar Trim Panel**

7. Remove the roof inner handle.

 **Roof Inner Handle**

8. Remove the driver side glasses box.

 **Driver Side Glasses Box**

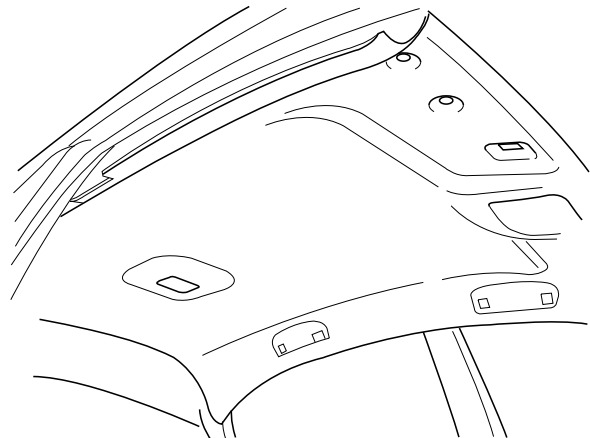
9. Remove the front map lamp.

 **Front Map Lamp**

10. Remove the rear map lamp.

 **Rear Map Lamp**

11. Loosen the 6 snap fits securing the roof interior.



12. Remove the sun visor.

 **Sun Visor**

13. Tilt the 2 front seats.

14. Remove the rear windshield.

 **Rear Windshield**

15. Move the roof interior away.

Refit

1. Tilt the 2 front seats.
2. Place the roof interior into the mounting position.
3. Fit the rear windshield.

 **Rear Windshield**

4. Fit the sun visor to position the roof interior, and

secure the roof interior with the snap fit.

5. Fit the driver side glasses box.

 **Driver Side Glasses Box**

6. Fit the roof inner handle.

 **Roof Inner Handle**

7. Fit the A pillar upper trim panel.

 **A Pillar Upper Trim Panel**

8. Fit the B pillar upper trim panel.

 **B Pillar Upper Trim Panel**

9. Fit the C pillar trim panel.

 **C Pillar Trim Panel**

10. Fit the front map lamp.

 **Front Map Lamp**


11. Fit the rear map lamp.

 **Rear Map Lamp**

12. Fit the front door sill trim panel.

 **Front Door Sill Trim Panel**

13. Fit the rear door sill trim panel.

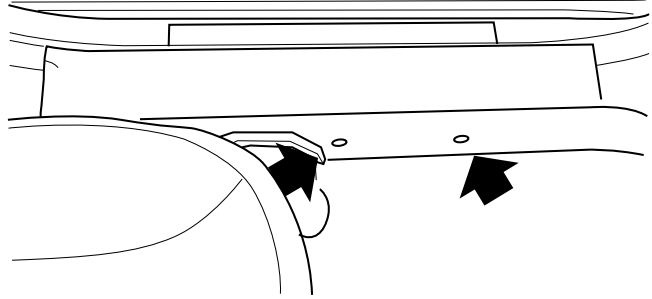
 **Rear Door Sill Trim Panel**

14. Connect the battery negative terminal.

Front Door Sill Trim Panel

Removal

1. Remove the front door weatherstrip.
2. Unscrew the 2 screws securing the front door sill trim panel to the body.



3. Remove the front door sill trim panel.

Refit

1. Secure the front door sill trim panel to the body, then fit the screws and tighten to **1.5-1.7 Nm**.
2. Fit the front door weatherstrip.

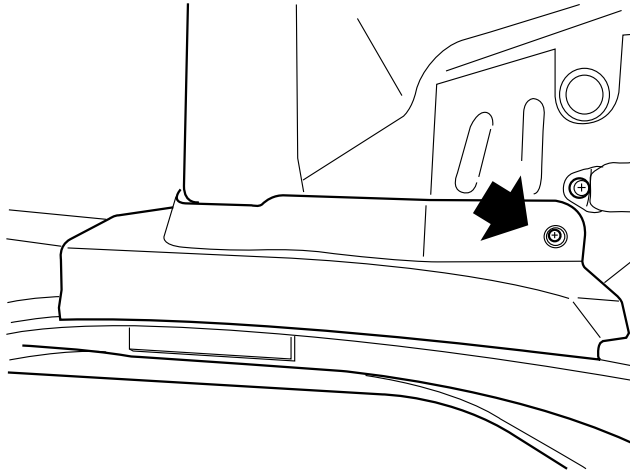
Rear Door Sill Trim Panel

Removal

1. Remove the rear door weatherstrip.
2. Remove the rear seat cushion.

 **Rear Seat Cushion**

3. Unscrew a bolt securing the rear door sill trim panel to the body.



4. Remove the rear door sill trim panel.

Refit

1. Secure the rear door sill trim panel to the body, then fit the bolt and tighten to **1.5-1.7 Nm**.
2. Fit the rear seat.

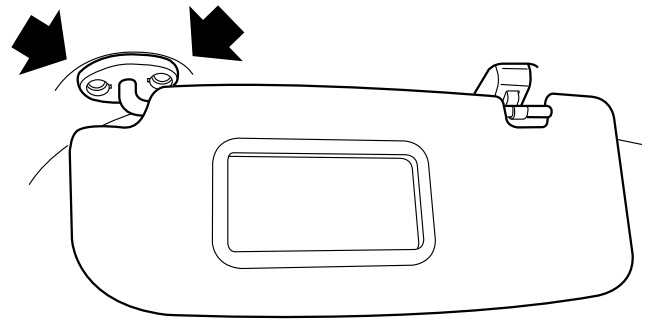
 **Rear Seat Cushion**

3. Fit the rear door weatherstrip.

Sun Visor

Removal

1. Remove the screw trim cover, and unscrew the 2 bolts securing the sun visor to the ceiling.



2. Disconnect the electrical connector.
3. Remove the sun visor from the ceiling.
4. Unscrew a bolt securing the sun visor bracket to the ceiling.



5. Remove the sun visor bracket from the ceiling.

Refit

1. Secure the sun visor bracket to the ceiling, then fit the screw and tighten to **4-6 Nm**.
2. Connect the electrical connector.
3. Secure the sun visor to the ceiling, then fit the screw and tighten to **4-6 Nm**.

Engine Bay Heat Shield Insulator

Removal

1. Remove the engine transmission case assembly.


 **Automatic Transmission Assembly**

 **Manual Transmission Assembly**

2. Remove the **ABS** adjuster.

 **ABS Adjuster**

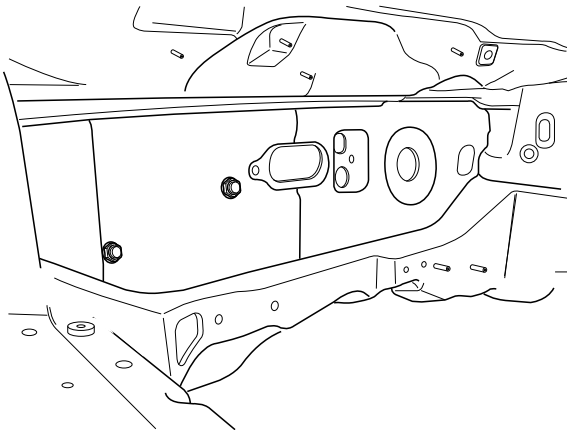
3. Remove the brake master cylinder and the reservoir tank assembly.

 **Brake Master Cylinder and Reservoir Tank Assembly**

4. Remove the vacuum booster assembly.

 **Vacuum Booster Assembly**

5. Disconnect the air conditioner heater water inlet and outlet pipe.
6. Disconnect the air conditioner water inlet and outlet pipe connecting the expansion valve.
7. Remove the 3 plastic nuts securing the engine bay heat shield insulator to the front of the body.



8. Remove the engine bay heat shield insulator.

Refit

1. Fit the engine bay heat shield insulator to the front of the body with the 3 nuts.
2. Connect the air conditioner water inlet and outlet pipe to the expansion valve.
3. The air conditioner heater water inlet and outlet pipe.
4. Fit the vacuum booster assembly.

 **Vacuum Booster Assembly**

5. Fit the brake master cylinder and the reservoir tank assembly.

 **Brake Master Cylinder and Reservoir Tank Assembly**

6. Fit the **ABS** adjuster.

 **ABS Adjuster**

7. Fit the engine transmission case assembly.

 **Automatic Transmission Assembly**

 **Manual Transmission Assembly**

Cowl Insulator

Removal

1. Remove the front seat.

 **Front Seat**

2. Remove the floor carpet.

 **Floor Carpet**

3. Remove the centre console.

 **Centre Console**

4. Remove the shift lever assembly.

 **Shift Lever Assembly – Automatic**

 **Shift Lever Assembly – Manual**

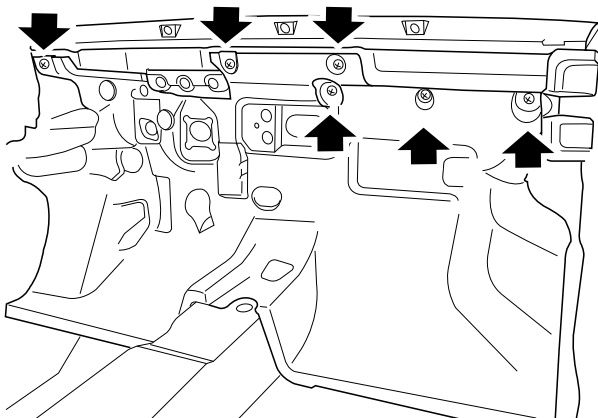
5. Remove the instrument panel assembly.

 **Instrument Panel Assembly**

6. Remove the brake pedal.

 **Brake Pedal**

7. Unscrew the 6 plastic nuts securing the cowl insulator to the front of the body.



8. Remove the cowl insulator.

Refit

1. Place the cowl insulator on the appropriate position of the body, and insert the location pin into the positioning hole.
2. Secure the cowl insulator to the body with the 6 nuts.
3. Fit the brake pedal.

 **Brake Pedal**

4. Fit the instrument panel assembly.

 **Instrument Panel Assembly**

5. Fit the shift lever assembly.

 **Shift Lever Assembly – Automatic**

 **Shift Lever Assembly – Manual**

6. Fit the centre console.

 **Centre Console**

7. Fit the floor carpet.

 **Floor Carpet**

8. Fit the front seat.

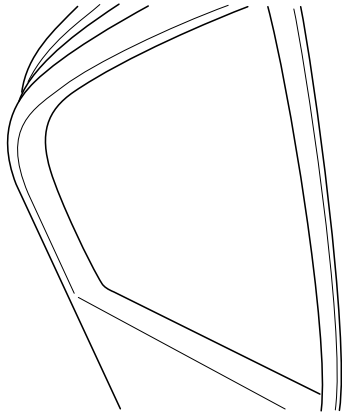
 **Front Seat**

Fixed Windows**Service Procedures****Quarter Window Glass****Removal**

1. Disconnect the battery negative terminal.
2. Remove the rear partition rail.

 **Rear Partition Rail**

3. Remove the quarter window glass weatherstrip.



S91013

4. Remove the quarter window glass.

Refit

1. Fit the quarter window glass.
2. Fit the quarter window glass weatherstrip.
3. Fit the rear partition rail.

 **Rear Partition Rail**

4. Connect the battery negative terminal.

Front Windshield**Removal**

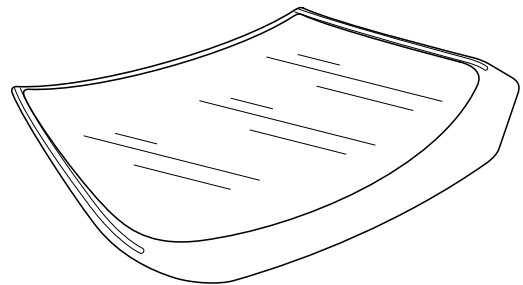
1. Remove the intake grille.

 **Air Conditioner Intake Grille Assembly**

2. Remove the inner rear view mirror.

 **Inner Rear View Mirror**

3. Disconnect the radio antenna connector on the windshield.
4. Remove the weatherstrip around the front windshield.
5. Cut adhesive around the front windshield with a glass sealer scraper.
6. Remove the front windshield from the vehicle.



S91014

7. Clear adhesive on the front windshield with a blade.
8. Clear adhesive on the front windshield frame with a blade.

Refit

1. Clean the mounting position of the front windshield on body completely with cleaner.
2. Apply cleaner to the area around the front windshield.
3. Fit new weatherstrip to the front windshield.
4. Coat the area around the front windshield with glass primer.
5. Apply body primer to the body assembly area.
6. Apply adhesive to the front windshield.
7. Fit the front windshield into the front windshield frame.
8. Apply tape to the weatherstrip, front windshield and front windshield frame so as to secure the front windshield.
9. Dry adhesive for 24 hours.
10. Remove the tape.
11. Pour water on the front windshield to check for water leak. If there is water leak, dry the front windshield and seal the leakage with adhesive. If water leak continues, remove the front windshield and repeat the whole repair procedures.

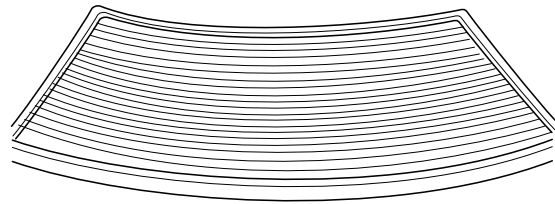
12. Connect the radio antenna connector on the windshield.
13. Fit the intake grille.

 **Air Conditioner Intake Grille Assembly**

Rear Windshield

Removal

1. Disconnect the battery negative terminal.
2. Disconnect the rear window defogger electrical connector.
3. Remove the weatherstrip around the rear window glass.
4. Cut adhesive around the rear windshield with a glass sealer scraper.
5. Remove the rear windshield from vehicle.



S91015

6. Clear adhesive on the rear windshield with a blade.
7. Clear adhesive on the rear windshield frame with a blade.

Refit

1. Clean the mounting position of the rear windshield on body completely with cleaner.
2. Apply cleaner to the area around the rear windshield.
3. Coat the area around the rear windshield with glass primer.
4. Apply body primer to the body assembly area.
5. Apply adhesive to the rear windshield.
6. Fit the rear windshield into the rear windshield frame.
7. Apply tape to the weatherstrip, rear windshield and rear windshield frame so as to secure the rear windshield.
8. Dry adhesive for 24 hours.
9. Remove the tape.
10. Pour water on the rear windshield to check for water leak. If there is water leak, dry the rear windshield and seal the leakage with adhesive. If water leak continues, remove the rear windshield and repeat the whole repair procedures.

Bumpers, Fascias and Grille**Specifications****Torque**

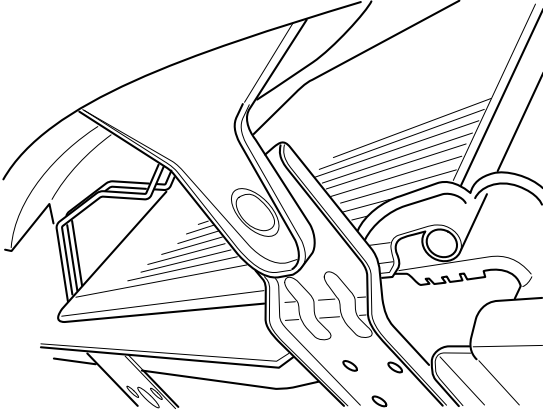
| Description | Value |
|------------------------------------|------------|
| Screw - Front Bumper Armature | 50-63 Nm |
| Nut - Rear Bumper Mounting Bracket | 2.7-3.3 Nm |
| Screw - Rear Bumper Armature | 19-23 Nm |

Service Procedures

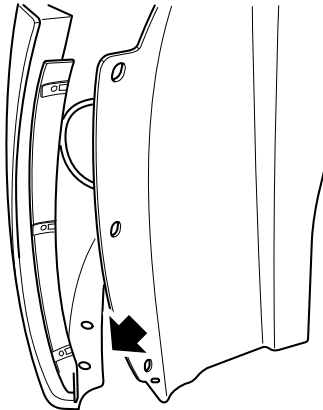
Front Bumper

Removal

1. Disconnect the battery negative terminal.
2. Remove the front wheel housing trim panel.
3. Unscrew the 6 screws under the front bumper.

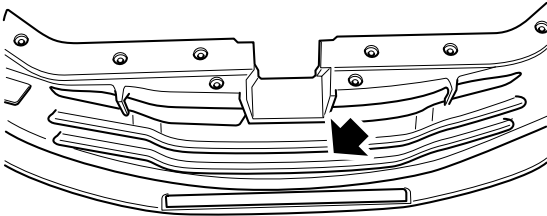


4. Unscrew the 8 screws inside the front bumper wheel housing.



S920002

5. Unscrew the 6 screws over the bumper.



S920003

6. Remove the front bumper bracket screws.
7. Remove the front bumper.

Refit

1. Fit the front bumper bracket with screws.

2. The front bumper is stuck to the front bumper bracket through groove.
3. Fit the screws on bumper.
4. Fit the screws inside the front bumper wheel housing.
5. Fit the screws under the front bumper.
6. Fit the front wheel housing trim panel.
7. Connect the battery negative terminal.

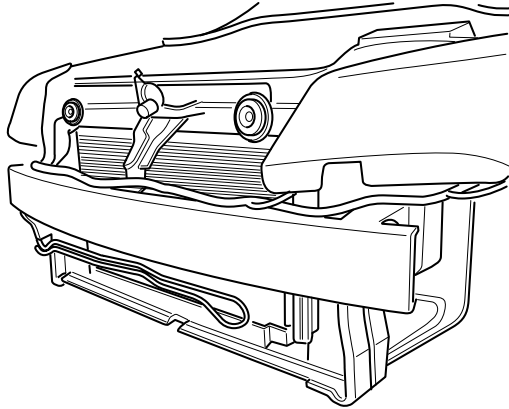
Front Armature

Removal

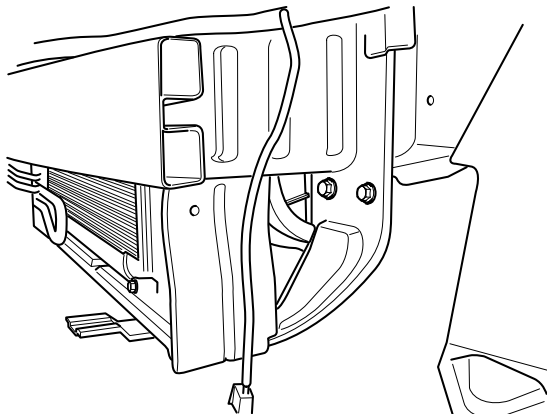
1. Disconnect the electrical connector.
2. Remove the front bumper.

 **Front Bumper**

3. Unscrew the 6 bolts and the front bumper armature.



S920004



S920005

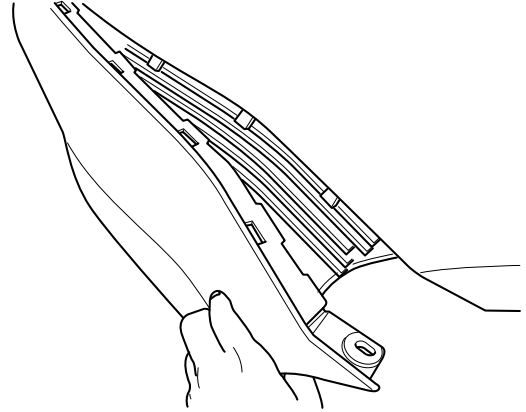
Refit

1. Hold the bolts to the front bumper armature, and tighten to **50-63 Nm**.
2. Fit the front bumper.
3. Connect the electrical connector.

Rear Bumper

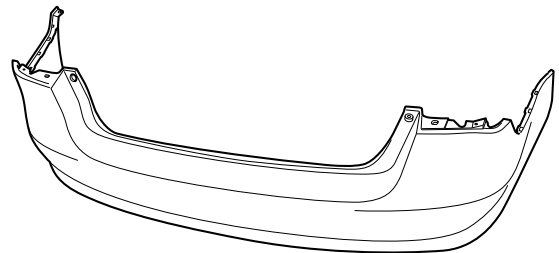
Removal

1. Disconnect the electrical connector.
2. Unscrew the screws and the splash shield.
3. Unscrew the 10 screws inside the wheel housing.



S920006

4. Unscrew the 3 screws at the lower side.



S920007

5. Unscrew the rear bumper bracket screws.
6. Remove the rear bumper.

Refit

1. Hold the screws to the rear bumper bracket, and tighten them to **2.7-3.3 Nm**.
2. The rear bumper is stuck to the rear bumper bracket through groove.
3. Fit the screws at the lower side.
4. Fit the screws inside the wheel housing.
5. Fit the screws and the splash shield.
6. Connect the electrical connector.

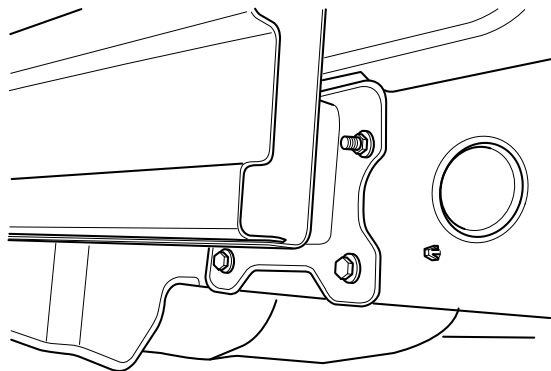
Rear Armature

Removal

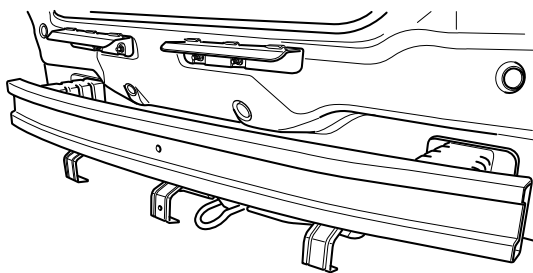
1. Remove the rear bumper.

Rear Bumper

2. Unscrew the 6 bolts and the rear armature.



S920008



S920009

Refit

1. Fit the rear armature with screws, and tighten them to **19-23 Nm**.
2. Fit the rear bumper.

EXterior Trim and Paneling**Specifications****Torque**

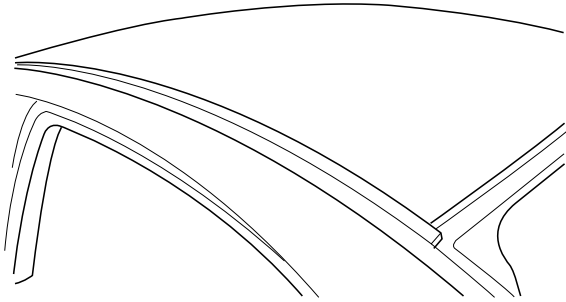
| Description | Value |
|---|----------|
| Bolt - Rear License Plate Trim Board | 2-2.5 Nm |
| Bolt - Front Wheel Housing Pad | 1-1.5 Nm |
| Bolt - Rear Wheel Housing Pad Front Plate | 1-1.5 Nm |
| Bolt - Rear Wheel Housing Pad Rear Plate | 1-1.5 Nm |
| Bolt - Bottom Wind Deflector Panel | 2-2.5 Nm |

Service Procedures

Roof Garnish

Removal

1. Remove the roof garnish.



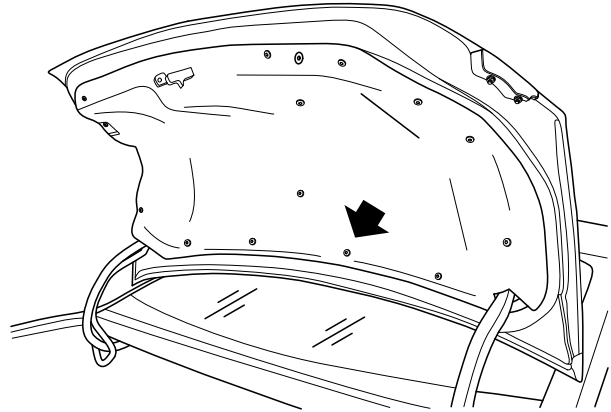
Refit

1. Hold the header garnish mounting snap fits into roof groove with designated sealer (if snap fits came off or damaged).
2. Fit the roof garnish.

Rear License Plate Trim Board

Removal

1. Disconnect the battery negative terminal.
2. Open the rear trunklid.
3. Remove the 17 snap fits securing the rear trunklid inner garnish, and remove the rear trunklid inner garnish.



4. Unscrew the 4 bolts securing the rear license plate trim board to the body.
5. Disconnect the electrical connector.
6. Remove the rear license plate trim board.
7. Remove the rear license plate light.

Rear License Plate Light Assembly

Refit

1. Fit the rear license plate light.

Rear License Plate Light Assembly

2. Connect the electrical connector.
3. Hold the rear license plate trim board to the body, fit the bolts and tighten them to **2-2.5 Nm**.
4. Fit the rear trunklid inner garnish.
5. Close the rear trunklid.
6. Connect the battery negative terminal.

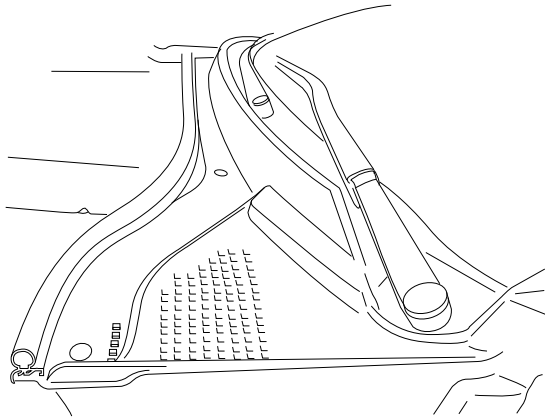
Air Conditioner Air Intake Grille Assembly

Removal

1. Open the bonnet and support it with a strut rod.
2. Remove the weatherstrip.
3. Remove the windshield wiper arm assembly.

 **Windshield Wiper Arm Assembly**

4. Remove the 6 snap fits securing the air conditioner intake grille (LH: 3, RH: 3), and remove the air conditioner intake grille.



Refit

1. Hold the air conditioner intake grille with the 6 snap fits.
2. Fit the windshield wiper arm assembly.

 **Windshield Wiper Arm Assembly**

3. Fit the weatherstrip.

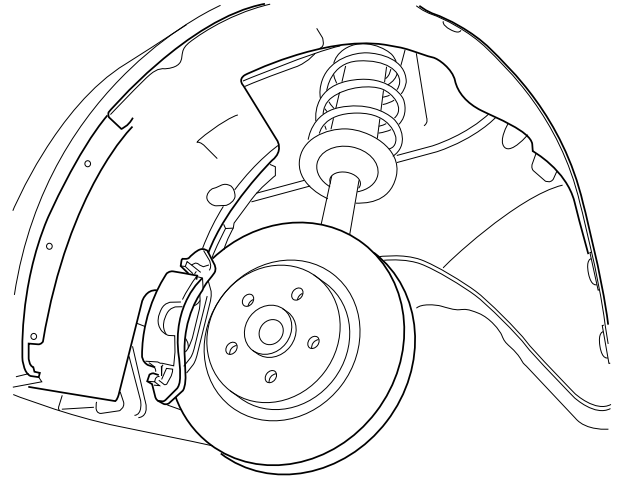
Front Wheel Housing Pad

Removal

1. Lift and support the vehicle properly.
2. Remove the front wheels.

 **Wheel**

3. Remove the front splash shield (if equipped).
4. Unscrew the screws.



5. Remove the front wheel housing pad.

Refit

1. Fit the front wheel housing pad, cotter pin and tighten the screws to **1-1.5 Nm**.
2. Fit the front splash shield.
3. Fit the front wheels.

 **Front Wheels**

4. Lower the vehicle.

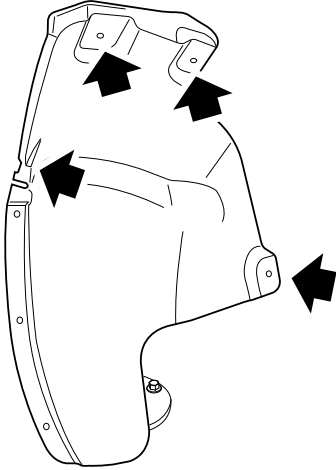
Rear Wheel Housing Pad - Front Plate

Removal

1. Lift and support the vehicle properly.
2. Remove the rear wheels.

Wheel

3. Remove the rear splash shield (if equipped).
4. Unscrew the 2 screws and 3 snap fits.



5. Remove the rear wheel housing pad front plate.

Refit

1. Fit the rear wheel housing pad front plate, cotter pin and tighten the screws to **1-1.5 Nm**.
2. Fit the rear splash shield.
3. Fit the rear wheels.
4. Lower the vehicle.

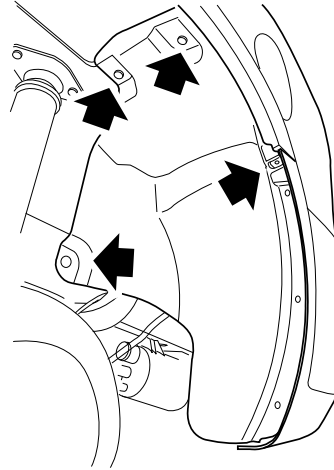
Rear Wheel Housing Pad - Rear Plate

Removal

1. Lift and support the vehicle properly.
2. Remove the rear wheels.

Wheel

3. Remove the rear splash shield (if equipped).
4. Unscrew the 2 screws, 3 snap fits and the rear wheel housing pad rear plate.



Refit

1. Fit the screws, rear wheel housing pad rear plate and cotter pin, and tighten the screws to **1-1.5 Nm**.
2. Fit the rear splash shield.
3. Fit the rear wheels.
4. Lower the vehicle.

Bottom Wind Deflector Panel**Removal**

1. Raise the vehicle on a lift.
2. Unscrew the 8 bolts securing the bottom wind deflector panel to the vehicle, and remove the bottom wind deflector panel.

Refit

1. Position the bottom wind deflector panel, then secure it with bolts and tighten them to **2-2.5 Nm**.
2. Lower the vehicle.

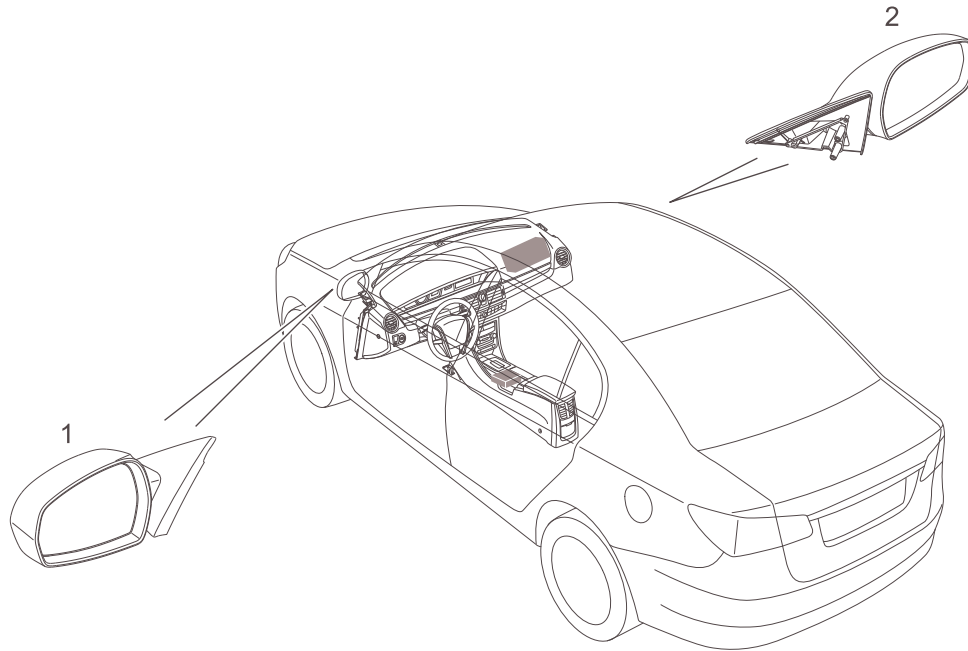
Mirrors**Specifications****Torque**

| Description | Value |
|---------------------------------------|--------|
| Bolt -Outer Rear View Mirror Mounting | 5-7 Nm |

Description and Operation

System Component Layout

Outer Rear View Mirror Component Layout



1. Outer Rear View Mirror Set LH

2. Outer Rear View Mirror Set RH

Service Procedures

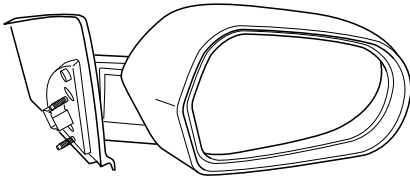
Outer Rear View Mirror Assembly

Removal

1. Remove the front door inner garnish.

Front Door Inner Garnish

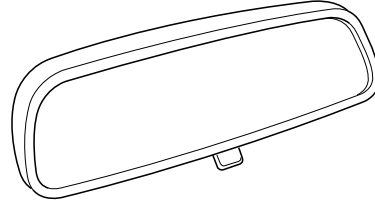
2. Remove the 3 snap fits securing the triangle trim panel inside the front door to the door.



Manual Glare-Resistant Inner Rear View Mirror Assembly

Removal

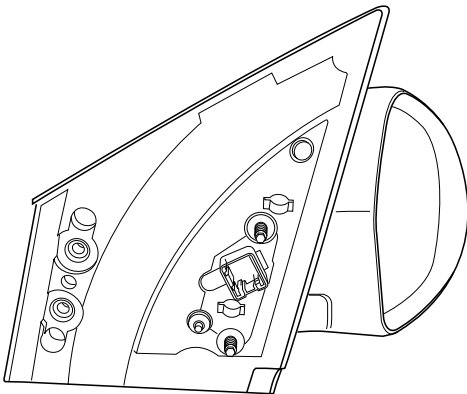
1. Tap off the inner rear view mirror assembly carefully with a rubber hammer, to remove it from the socket.



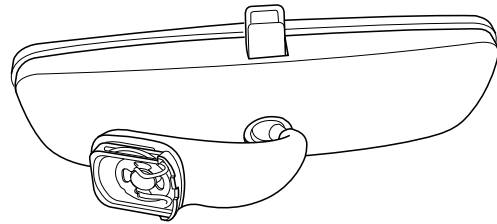
S940003

S940001

3. Remove the waterproof film, then you can see the outer rear view mirror connector plug, and disconnect the connector.



S940004



Refit

1. Position the inner rear view mirror to the mounting bracket, and push it carefully into the slot in order to make it fully seated.

S940002

4. Unscrew the 3 bolts securing the outer rear view mirror to the door, and remove the outer rear view mirror assembly.

Refit

1. With the location pin on the outer rear view mirror assembly, position this assembly into the corresponding positioning hole on the door, then fit and tighten the 3 bolts to **5-7 Nm**.
2. Connect the outer rear view mirror connector, and fit the waterproof film.
3. Fit the triangle trim panel inside the front door.
4. Fit the front door inner garnish.

Front Door Inner Garnish

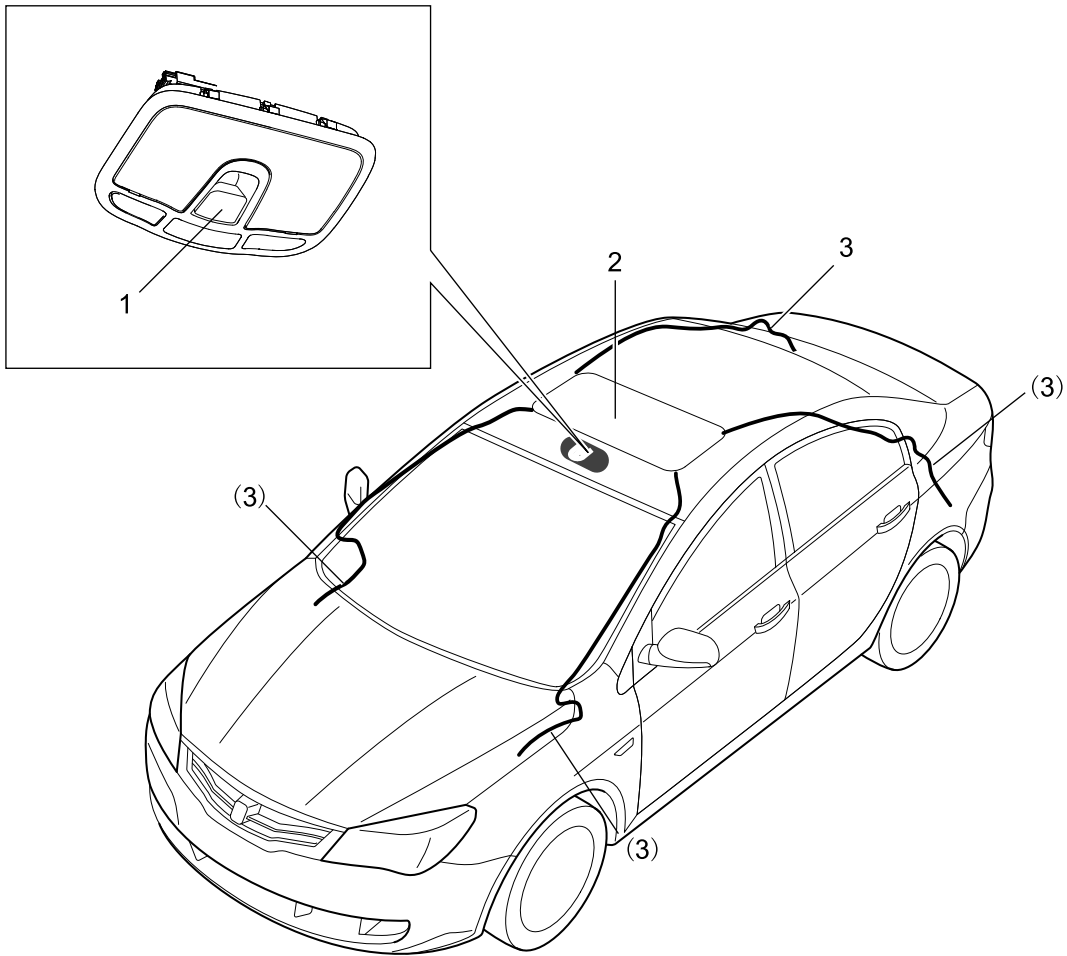
**Roof
Specifications
Torque**

| Description | Value |
|--------------------------|------------|
| Screw - Sunroof Assembly | 8.8 Nm |
| Screw - Sunroof Glass | 5.5±0.5 Nm |
| Screw - Sunroof Motor | 3.8 Nm |

Description and Operation

System Component Layout

Sunroof Component Layout

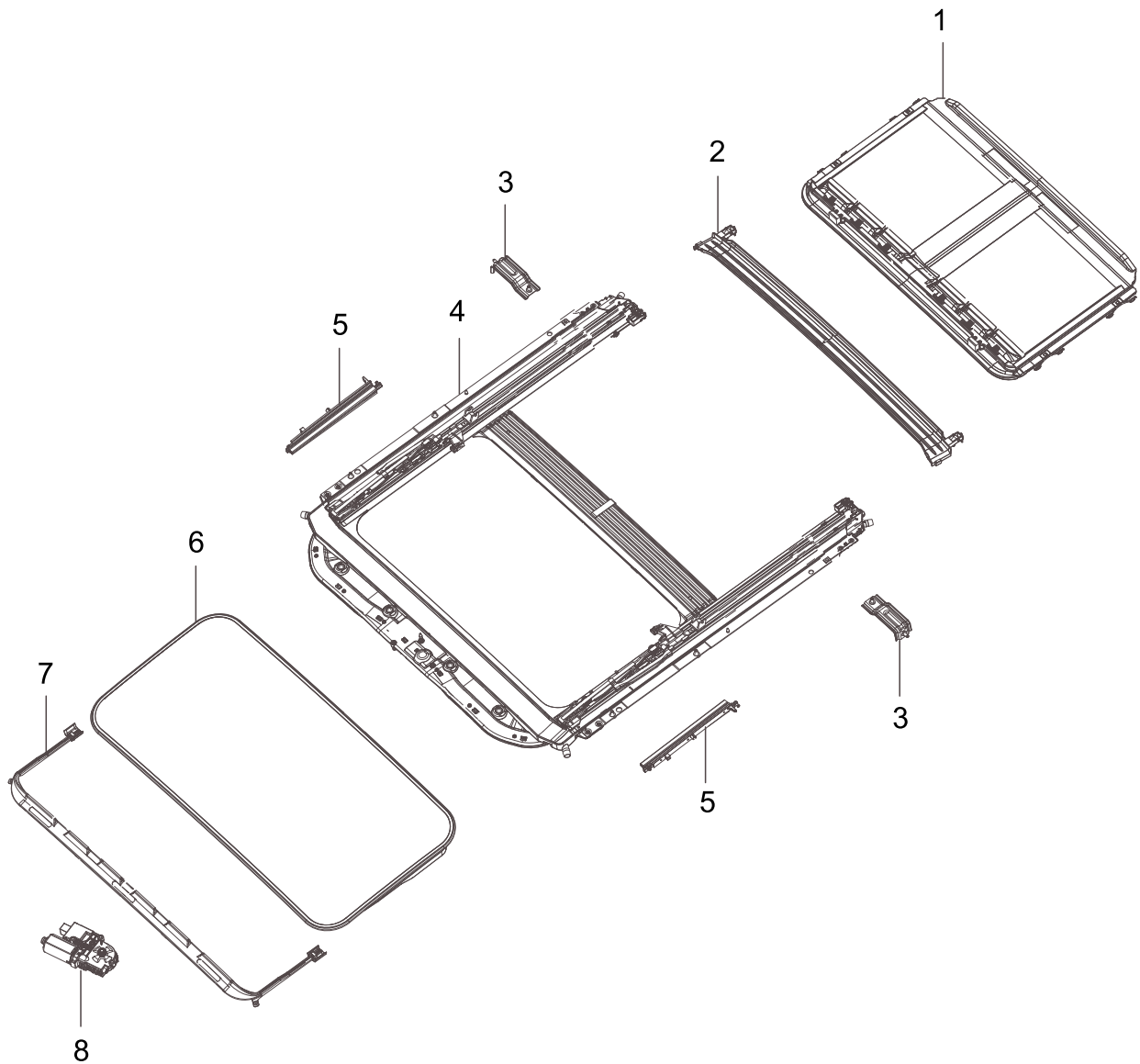


1. Sunroof Rotary Switch

2. Sunroof Assembly

3. Drain Tube (four)

Image of Sunroof Assembly Construction



1. Sun Visor Assembly

2. Drip Channel

3. Mounting Bracket

4. Frame Assembly

5. Sunroof Protection Cover

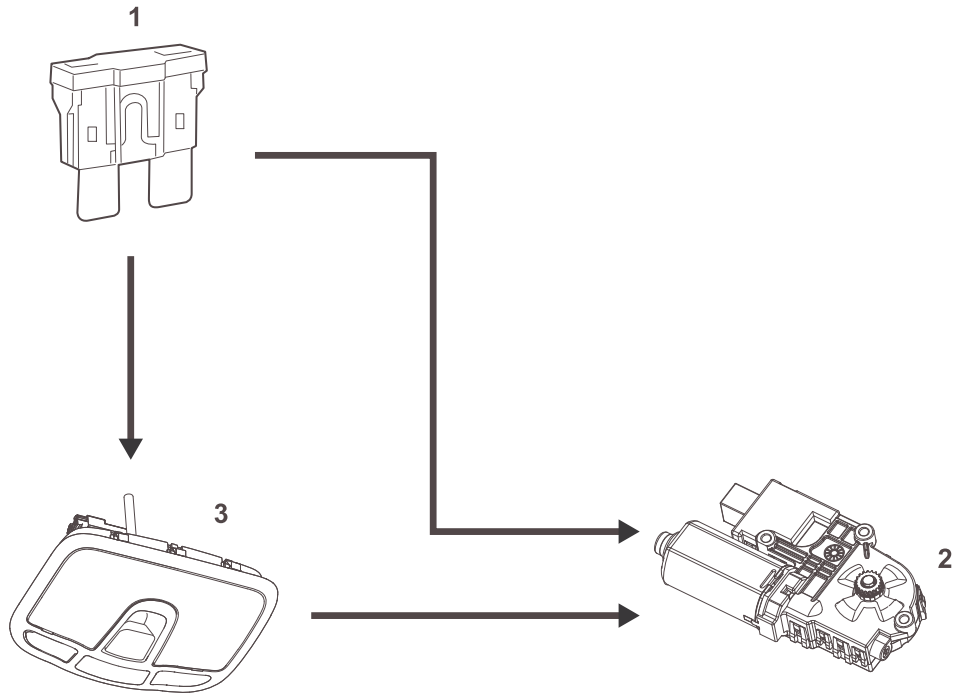
6. Sunroof Glass Assembly

7. Wind Deflector Panel Assembly

8. Sunroof Electronic Control Unit (ECU) and Motor

System Control Diagram

Sunroof System Control Diagram



A —————

A = Hard Wire

- 1. Fuse
- 2. Sunroof Electronic Control Unit (**ECU**) and Motor
- 3. Sunroof Rotary Switch

Description**General Description**

The sunroof is controlled by the drive motor and has the tilt mode and slide mode as well as the spoiler and sun visor.

This sunroof system has a function of one-touch slide open. All the operations to the sunroof system are performed by a rotary switch.

Switch

The rotary switch controls the tilt and slide operations of the sunroof.

Turning the switch can control the contact point inside the switch, and the generated ground output is transmitted to the motor and drive unit inside the sunroof assembly. The sunroof electronic control unit (**ECU**) analyses the ground signal, and then supplies power to the motor, to drive sunroof glass plate to move in the required directions.

Sunroof Control Signal (RF003)

| Pin 4 | Pin 5 | Description |
|----------------------|-------|-----------------------|
| 0 | 0 | No action |
| 1 | 0 | Slide open/tilt close |
| 0 | 1 | Slide close/tilt open |
| 0 = Open; 1 = Ground | | |

Input and Output of the Motor and Drive Unit

Sunroof**ECU** and motor are both powered by battery through the fuse in **BCM**. The connection of the system earth lead is used for the operation of **ECU**, motor and switch. Switch ground signal and both control signals of the sunroof are input by the switch.

Operation

General Description

- Long Press

Push and hold the sunroof switch

- Short Press

Press the sunroof switch once, and then release it.

Manual Tilt/Close Operation

With the sunroof glass plate closed or half-tilted, if press and hold the sunroof OFF switch, the sunroof glass plate will tilt open, and stop operating when the switch is released after the glass plate reaches the required position.

With the sunroof glass plate tilted, press and hold the sunroof ON switch to make the sunroof glass plate close, and the sunroof plate stops operating when the switch is released after the sunroof glass plate reaches the required position. While closing, it is necessary to press and hold the switch until the sunroof machine set does not respond, in order to make sure that the sunroof is fully closed.

Manual Slide/Close Operation

With the sunroof glass plate closed or half slide open, press and hold the sunroof ON switch to make the sunroof glass plate slide open, and the glass plate stops operating when the switch is released after the sunroof glass plate reaches the required position.

With the sunroof glass plate slides open, long press the sunroof OFF switch to make the sunroof glass plate close, and the glass plate stops operating when the switch is released after the sunroof glass plate reaches the required position.

One-touch Slide Open/Close Operation

With the sunroof glass plate closed or half slide open, short press the sunroof ON switch to make the sunroof glass plate slide automatically, and it stops if you short press any switch during operation.

One-touch Tilt Open/Close Operation

With the sunroof glass plate closed or half tilted, short press the sunroof OFF switch to make the sunroof glass plate slide to fully open automatically, and it stops if you short press any switch during operation.

Sunroof with Two Opening Methods

When one-touch slide is on, the sunroof glass plate drives the sun visor to a certain position, if the ON switch is pushed again, the sunroof glass plate brings the sun visor to hide into the vehicle to get a maximum opening size. While closing, glass plate drives the sun visor to move forward. The sun visor stops when its handle comes out, but the glass plate continues moving forward to the closed position, the sun visor can be manually full closed at this time.

Key Control Function

After exiting the vehicle with the engine off, insert the key into driver side door lock and turn it counterclockwise and hold for more than 2 seconds to enable this function, and all the doors and sunroof can be closed simultaneously. Release the key, and the sunroof stops immediately.

Initialization of Motor

The motor needs to be initialized mainly after the power is cut off or the use of the sunroof reaches 100 cycles (one cycle refers to the motor rotates forward and backward twice); the initialization refers to that the glass plate raises to the top point and the switch continues to be held for 2 seconds (this action is necessary), the glass plate maybe shudder (this action is not necessary), and the initialization completes.

It is necessary to initialize the sunroof motor when the sunroof can only move forward and not backward or the sunroof does not open backward with one-touch after sunroof control procedure has failed.

Sunroof Restore Forcibly

If the sunroof cannot close to the position, press and hold the OFF switch for 10 seconds, the sunroof will automatically operate to the close condition.

Emergency Operation (Manual Handling)

If the control system has a malfunction, remove the front map lamp cover, then a inner hexagon screw hole at the lower side of the sunroof motor can be seen. Using the tools (inner hexagon wrench) to manually open the sunroof by turning counterclockwise and manually close the roof by turning clockwise.

Service Procedures

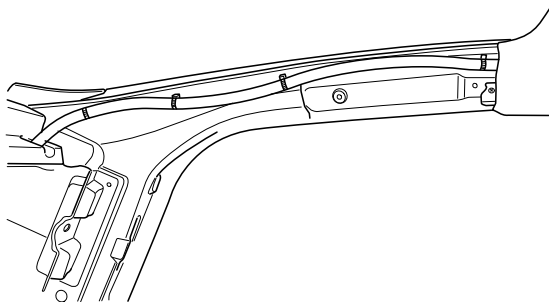
Sunroof Assembly

Removal

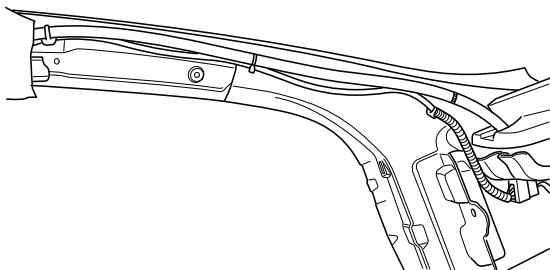
1. Remove the roof inner garnish.

 **Roof Inner Garnish**

2. Disconnect the 4 drain tubes from the sunroof assembly.

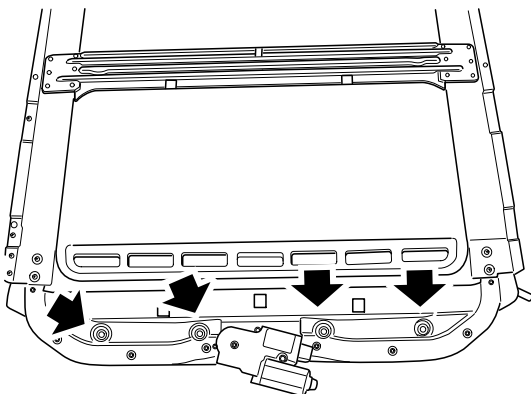


S950002

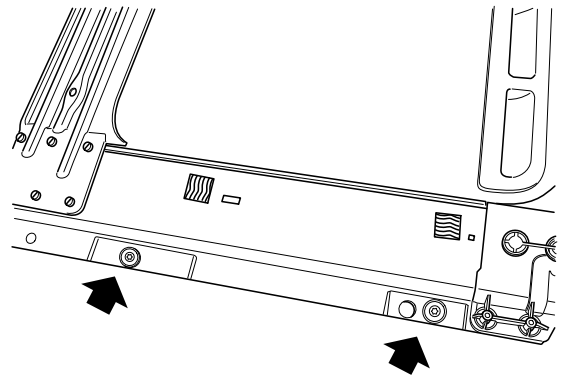


S950001

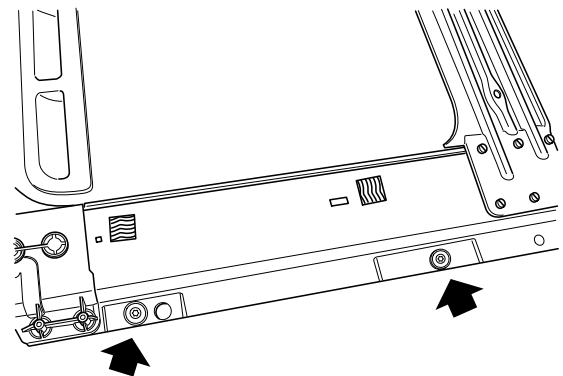
3. Disconnect the motor connector.
4. With the help of an assistant, unscrew the 10 screws securing the sunroof assembly to the body.



S950003



S950004



S950005

5. Remove the sunroof assembly.

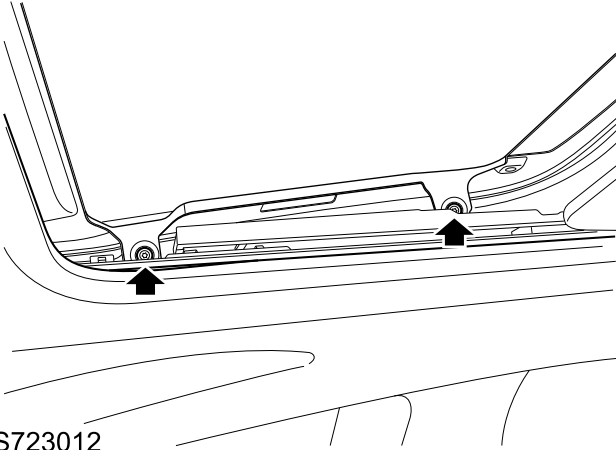
Refit

1. Connect the motor connector.
2. With the help of an assistant, position the sunroof assembly to the body, then fit the screws and tighten them to **8.8 Nm**.
3. Connect the drain tubes to the sunroof assembly.
4. Fit the roof inner garnish.

 **Roof Inner Garnish**

Sunroof Glass Assembly**Removal**

1. Disconnect the battery negative terminal, when the sunroof moves to the closed position.
2. Open the sunroof sun visor assembly.
3. Remove the sunroof protection covers on both sides.
4. Unscrew the 4 screws securing the glass assembly.



S723012

5. Remove the sunroof glass assembly.

Refit

1. Position the sunroof glass assembly onto the body, and fit the screws and DO NOT tighten them temporarily.
2. Align the glass assembly with the body, the alignment point should be 300 mm away from the two sides of the body centreline.
3. Tilt down the front edge of the sunroof glass, which has been aligned with the body, to form a 1.0 mm height difference.
4. Tilt up the rear edge of the sunroof glass, to form a 1.0 mm height difference.
5. To test the match of the roof and sunroof, open and close the sunroof. Insert a piece of paper between the sunroof and weatherstrip, close the sunroof glass and draw out the paper. If a slight resistance exists when you are drawing out the paper, it indicates a correct match.
6. Fasten the mounting screws of the sunroof glass assembly, and tighten them to **5.5±0.5 Nm**.
7. Connect the battery earth lead.
8. Refer to Description and Operation to initialize the sunroof motor.
9. Operate the sunroof to check for the alignment condition.
10. Close the sunroof sun visor.

Sunroof Glass Weatherstrip**Removal**

1. Remove the sunroof glass assembly.

 **Sunroof Glass Assembly**

2. Loosen the weatherstrip from the glass assembly, and remove the weatherstrip from the seal groove.

Refit

1. Engage the weatherstrip into the glass seal groove, and make sure that the weatherstrip matches properly around the sunroof glass.
2. Fit the sunroof glass assembly.

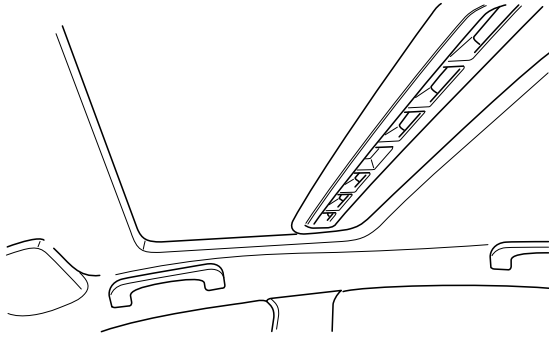
 **Sunroof Glass Assembly**

Track Type Sunroof Sun Visor Assembly**Removal**

1. Remove the sunroof glass assembly.

 **Sunroof Glass Assembly**

2. Winkle the one side slider out of the track directly with razor blade.



S950006

3. Remove the sunroof slider LH.
4. Loosen the sun visor from the track RH.

Refit

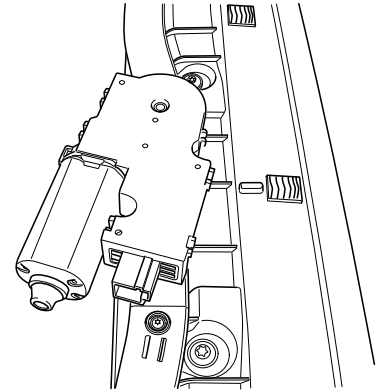
1. Make sure that the track RH matches the position.
2. Make sure that the rear slider LH is located at the back of the sunroof retainer.
3. Try to operate the sun visor to check for the match condition.
4. Fit the sunroof glass assembly.

 **Sunroof Glass Assembly****Sunroof Motor Assembly****Removal**

1. Disconnect the battery negative terminal.
2. Remove the sunroof assembly.

 **Sunroof Assembly**

3. Unscrew the 3 screws securing the motor.



S950007

4. Disconnect the connector and remove the motor.

Refit

1. Position the sunroof motor, and engage the motor drive gear into the sunroof cable.
2. Fit and fasten the 3 sunroof motor mounting screws, and tighten them to **3.8 Nm**.
3. Fit the sunroof assembly.

 **Sunroof Assembly**

4. Connect the connector and turn on the ignition switch. When the sunroof switch is in the slide close or tilt open position, hold it for 15 seconds, and then the motor initialization is completed.

Sunroof Front Drain Tube

Removal

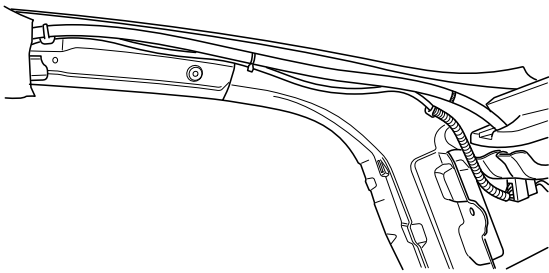
1. Remove the roof inner garnish.

 **Roof Inner Garnish**

2. Remove the A pillar upper trim panel assembly.
3. Remove the A pillar lower trim panel assembly.
4. Remove the instrument panel assembly.

 **Instrument Panel Assembly**

5. Remove the drain tube from the sunroof.



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6. Remove the drain water valve connected to the drain tube from the body.
7. Remove the drain water valve from the drain tube, and put it away.

Refit

1. Fit the appropriate snap fit of the drain tube into the body panel hole. The opening end surface of the snap fit faces downward.
2. Insert the drain water valve to the appropriate position of the body.
3. Connect the lower end of the drain tube to the drain water valve.
4. Connect the upper end to the sunroof drain tube.
5. Engage the corresponding wire to the water pipe snap fit (front water pipe LH).
6. Fit the instrument panel assembly.

 **Instrument Panel Assembly**

7. Fit the A pillar upper trim panel assembly.
8. Fit the A pillar lower trim panel assembly.
9. Fit the roof inner garnish.

 **Roof Inner Garnish**

Sunroof Rear Drain Tube

Removal

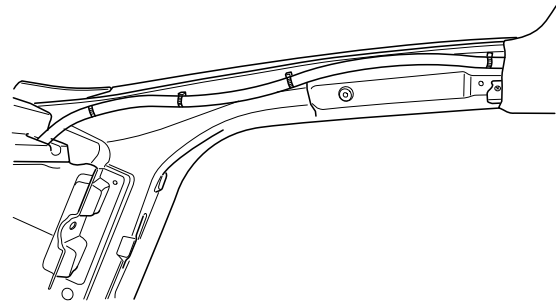
1. Remove the roof inner garnish.

 **Roof Inner Garnish**

2. Remove the rear seatback assembly.

 **Rear Seatback Hinge**

3. Remove the C pillar upper trim panel assembly.
4. Remove the C pillar lower trim panel assembly.
5. Remove the rear drain tube from the sunroof.



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6. Remove the snap fit that connect to the water pipe from the body.
7. Remove the drain water valve on the rear drain tube from the body.
8. Remove the drain water valve from the drain tube, and put it away.

Refit

1. Fit the upper end of the rear drain tube into the sunroof rear water outlet.
2. Fit the snap fit on the drain tube to the appropriate position of the body. The opening end surface of the snap fit faces upward.
3. Insert the drain water valve to the appropriate position of the body.
4. Pass the rear drain tube bellow through the rear drain tube.
5. Fit the C pillar upper trim panel assembly.
6. Fit the C pillar lower trim panel assembly.
7. Fit the rear seatback assembly.

 **Rear Seatback Hinge**

8. Fit the roof inner garnish.

 **Roof Inner Garnish**

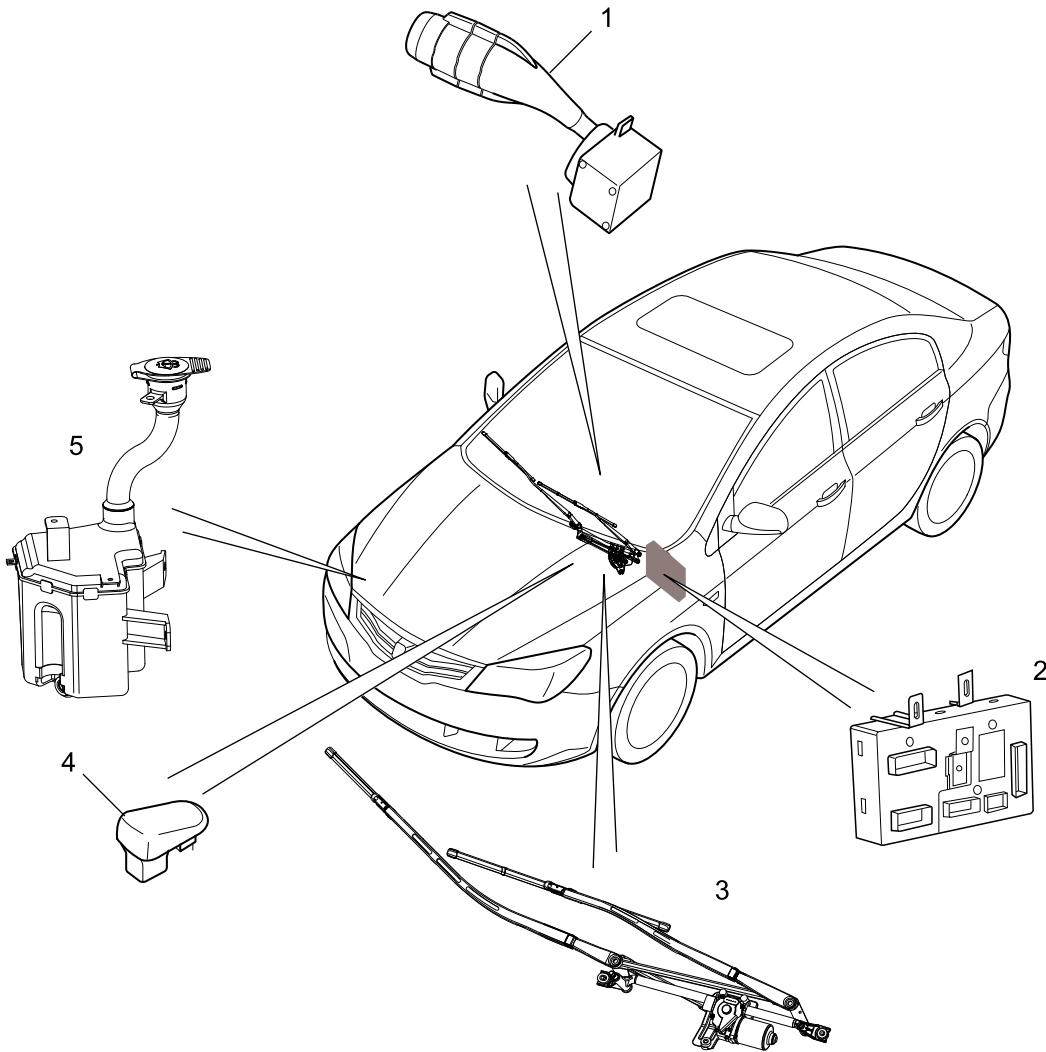
Wipers and Washer**Specifications****Torque**

| Description | Value |
|----------------------------------|----------|
| Nut - Front Windshield Wiper Arm | 20-30 Nm |
| Screw - Wiper Mounting Bracket | 4-10 Nm |
| Bolt - Windshield Washer System | 4-6 Nm |

Description and Operation

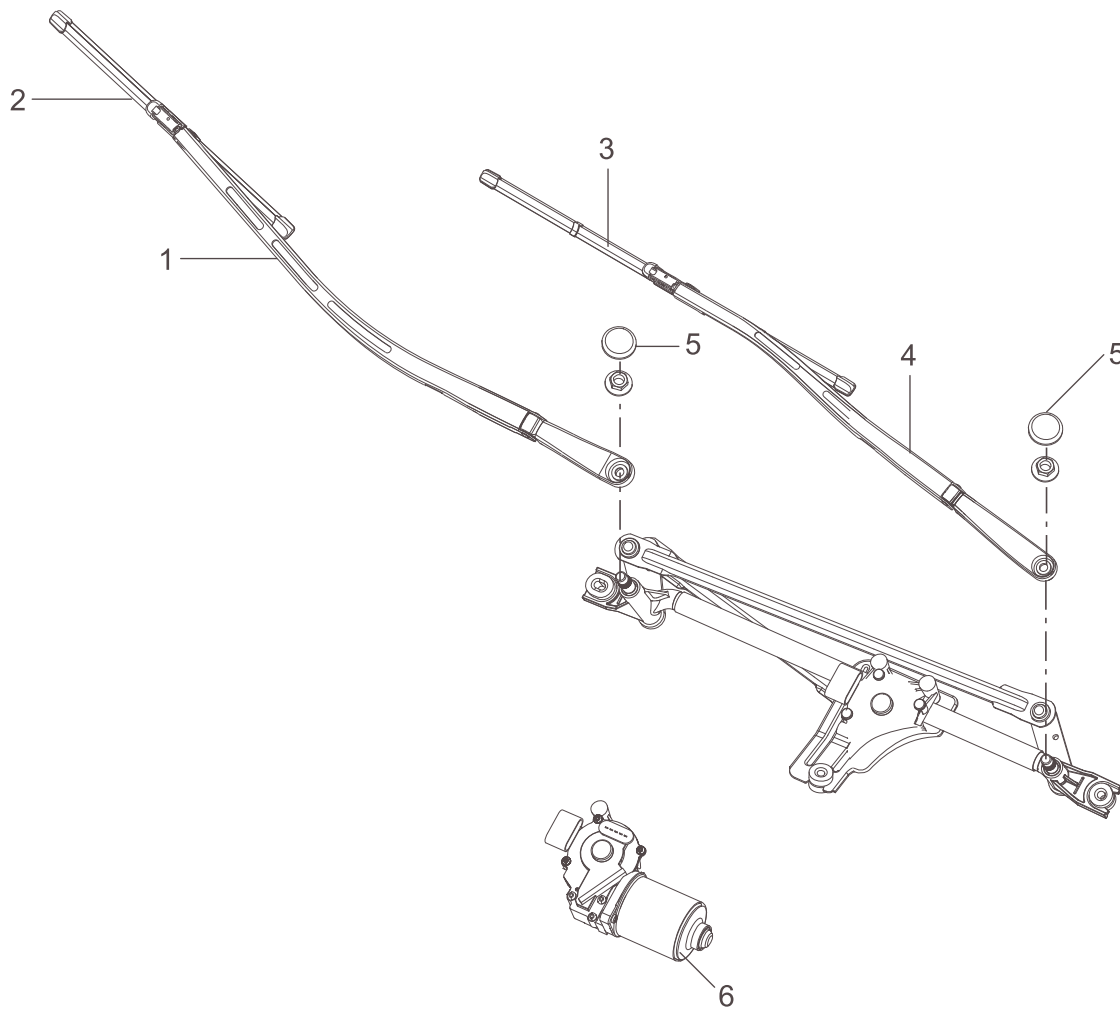
System Component Layout

Wiper and Washer Component Layout



- 1. Wiper/Washer Lever Switch
- 2. Body Control Module (**BCM**)
- 3. Windshield Wiper and Motor Assembly
- 4. Front Windshield Washer Nozzle
- 5. Washer Fluid Reservoir and Washer Pump

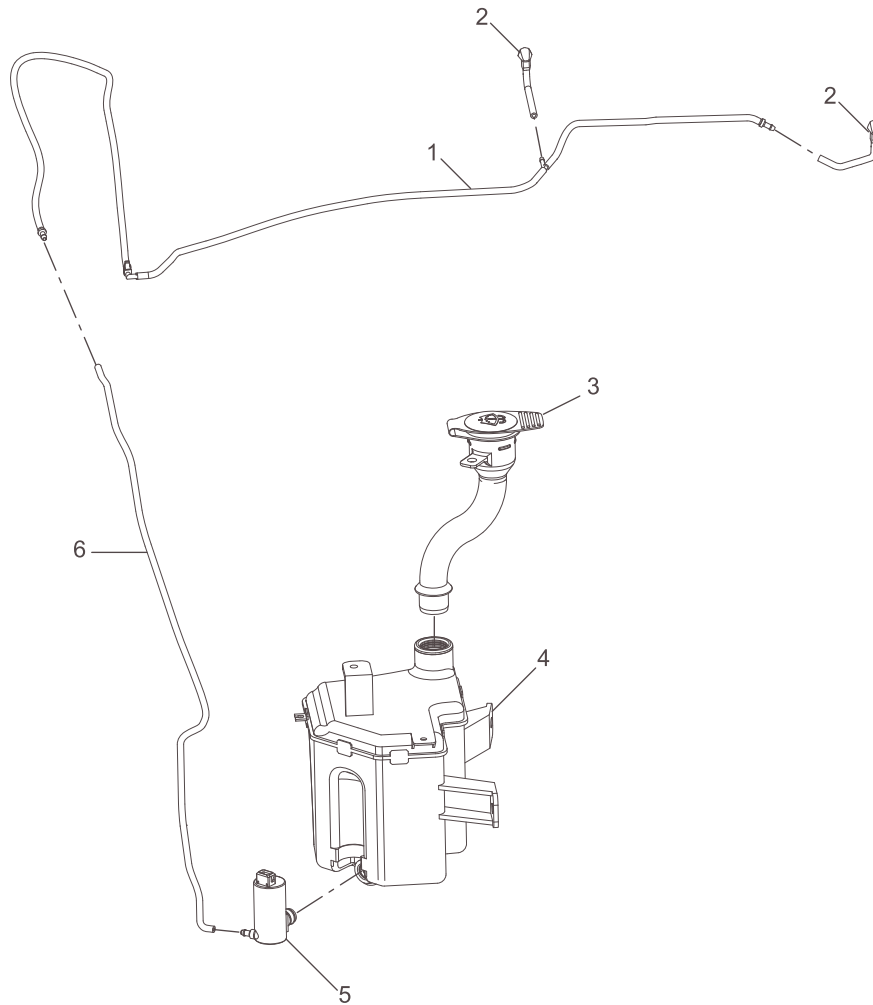
Wiper Exploded View



- 1. Passenger Side Wiper Arm Assembly
- 2. Passenger Side Wiper Blade Assembly
- 3. Driver Side Wiper Blade Assembly

- 4. Driver Side Wiper Arm Assembly
- 5. Shaft Cover
- 6. Wiper Motor

Washer Exploded View

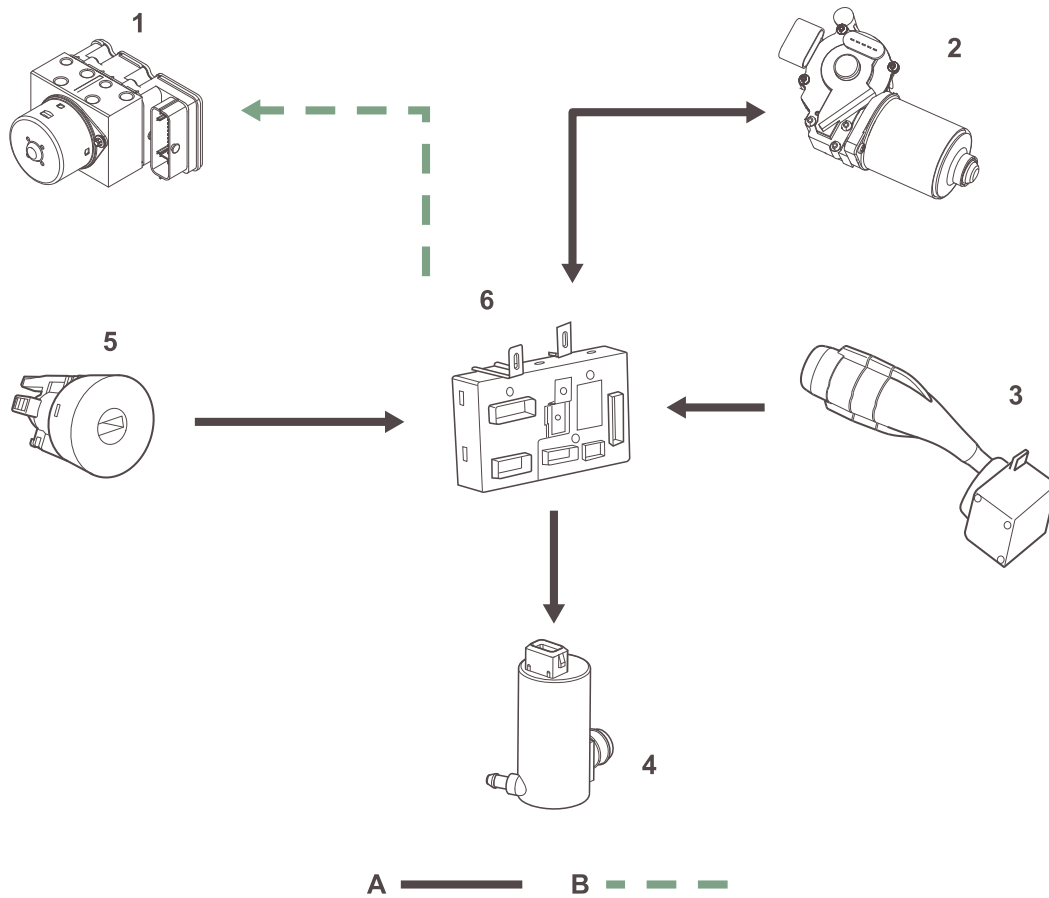


- 1. Front Windshield Washer Hose
- 2. Front Windshield Washer Nozzle
- 3. Washer Fluid Reservoir Neck

- 4. Washer Fluid Reservoir
- 5. Windshield Washer Pump
- 6. Washer Fluid Reservoir Hose

System Control Diagram

Wiper and Washer Control Diagram



A = Hard Wire; B =CAN High Speed Bus Line

- 1. **ABS** Control Module
- 2. Wiper Motor
- 3. Wiper/Washer Lever Switch
- 4. Washer Pump
- 5. Ignition Switch
- 6. Body Controller Module (**BCM**)

Description

General Description

Wiper and washer system is controlled by the body control module (**BCM**), and operates after it received a command from the driver or rain sensor (if equipped). Wiper functions are all controlled by wiper/washer lever switch assembly on the right side of the steering wheel. Wiper and washer system contains:

- Wiper Motor
- Wiper Link Mechanism
- Two Wiper Arms and Blades
- Two Washer Nozzles
- Washer Fluid Reservoir and Washer Pump
- Wiper/Washer Lever Switch

It is possible to operate the wiper function after the wireless key is inserted. The wiper functions are all paused immediately after starting engine.

Body Control Module, Load Management.

Read the diagnosis messages of the wiper and washer system by T5 scan tool.

Wiper/Washer Lever Switch

Wiper lever switch contains a 5th toggle switch and a rotary switch. The switch position of intermittent, low speed and high speed wiper operation and "OFF" position are locked, but the temporary operation switch and programmed washer/wiper operation switch are unlocked. Rotary switch is used for selecting the intermittent delay time.

Wiper Operation Mode

This wiper system supports the following operation mode:

- Programmed Washer/Wiper Operation
- Temporary Operation
- Low Speed Wiper Operation
- High Speed Wiper Operation
- Automatic (intermittent) Wiper Operation

Programmed Washer/Wiper Operation

Pull the lever switch towards the steering wheel, then the washer operates immediately. After a short interval, wiper and washer operate together. The wiper will continue to operate for 3 times after the lever switch is released. After a few seconds, the wiper will operate one more time to remove the washer fluid on the windshield.

Temporary Operation

When push upward the wiper/washer lever switch once from the stop position and release it quickly, the wiper will complete a low speed wiper operation. If the switch remains on, the wiper will operate at high speed, if the switch is off, the wiper

will complete wiper operation once at low speed until the motor reaches the stop position.

Low Speed Wiper Operation

When the switch is on and locked in the low speed position, wiper will operate continuously at low speed.

High Speed Wiper Operation

When the switch is on and is locked in the high speed position, wiper will operate continuously at high speed.

Automatic (intermittent) Wiper Operation

Select this mode when the wiper cannot operate continuously due to insufficient rain, so that the wiper blade will stay in the stop position until the selected delay time between twice wiper operations is ended. The delay time is determined by the toggle switch, the position of the intermittent delay rotary switch (four rotary switches, located at the wiper arm end) and vehicle sensors together.

When programmed wiper/washer operation mode is selected again after the intermittent wiper operation mode is selected, the programmed wiper/washer operation starts immediately, but the intermittent wiper operation restarts after the programmed wiper/washer operation is ended and motor reaches the stop position.

Wiper and Washer, Delay Time Related to Vehicle Speed

When the switch is in the intermittent, low speed, or high speed operation position, **BCM** will adjust the intermittent time according to the vehicle speed. **ABSECU** monitors the wheel speed signal and transmits it to **BCM** by **HSCAN** bus line. If the wiper switch is in the intermittent operation position, **BCM** compares the resistance related to vehicle speed and intermittent delay rotary switch position, and adjusts the selected delay time accordingly.

If the wiper switch is on and locked in the low speed position, and the vehicle driving speed is lower than 8 km/h, **BCM** will activate intermittent operation, the appropriate intermittent delay time is determined by the intermittent rotary switch that has been set.

Note: *If a longer time delay is reselected during intermittent operation, the time delay will be carried out when the next wiper operation starts; if a shorter time delay is reselected during the time delay, the new time delay will be carried out immediately.*

If the wiper switch is on and locked in the high speed position and the vehicle driving speed is lower than 8 km/h, the wiper speed will change to low speed operation. When the speed is higher than 8 km/h, the wiper will return to the intermittent operation which has the speed sensing function.

Wiper

The wiper motor is located in the lower side of the air intake grille under the windshield. This motor is fitted on a link mechanism on the bracket between inner and outer bulkhead. The motor is a DC motor which drives the worm wheel by the worm gear attached to the motor main shaft. External worm wheel is connected with the link mechanism, which can drive the wiper arm attached to the worm wheel block at the end of the link mechanism.

The motor receives two input signals from a 4-pin connector on the wire. The first input signal is 12V DC, which enables the motor to operate at high speed. The second input signal is 12V DC too, need a resistor in series, in order to reduce the voltage applied to the motor, making the motor speed become slower. The motor is grounded by the orbit of the internal gear.

The fourth pin of the motor connector is connected with the return control chip and handle the return switch of the motor.

The wiper arm is fitted on the link mechanism output shaft. There is a fulcrum between the wiper arms mounting points. Connect a spring at the both ends of the fulcrum, and apply appropriate pressure to the windshield wiper blade.

The blade of the boneless wiper is secured to the wiper arm with the clip, and it can turn freely at the mounting point of the wiper arm. This kind of structure ensures that the glass can be cleaned neatly in any wiper operation mode. Also it reduces noises and the wind resistance.

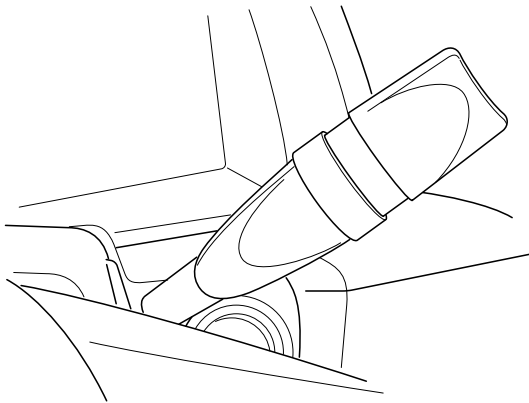
Windshield Washer

Windshield washer system contains the washer fluid reservoir, washer fluid reservoir neck, washer pump, washer nozzle, check valve, hose and hose joint.

The washer fluid reservoir is located inside the vehicle wheel house RH with capacity of approximately 3.8 L. Add washer fluid to washer fluid reservoir by the funnel neck with sealing cap in the engine bay. A washer pump is under the washer fluid reservoir.

When the washer pump starts to operate, the fluid in the pump will be sent to the washer nozzle at the rear edge of the engine cover by the pressure. Check valve in the line prevents the fluid of the nozzle and hose from flowing back into the washer fluid reservoir, thus ensuring the wiper is instant available.

Operation



S960001

1. Programmed Washer/Wiper Operation
2. Automatic (intermittent) Wiper Operation
3. Low Speed Wiper Operation (LO)
4. High Speed Wiper Operation (HI)
5. Intermittent Delay Rotary Switch FAST—SLOW
6. Temporary Operation (MIST)

Wiper

Intermittent, low speed, high speed and temporary wiper operation switches are all form a ground close loop with BCM through either wire of the switch unions 1 and 2. Combination ground loop is monitored by BCM via one or two signals from selected functions. Refer to the table below for combination condition.

| Switch Position | Switch 1 | Switch 2 |
|-------------------------------------|----------|----------|
| Stop | 0 | 0 |
| Temporary Operation | I | I |
| Intermittent Wiper Operation | I | 0 |
| Low Speed Wiper Operation | 0 | 0 |
| High Speed Wiper Operation | I | I |
| 0 = Open Circuit I = Closed Circuit | | |

Programmed Washer/Wiper Operation

Programmed washer/wiper operation function is controlled by BCM. When the switch is on, the washer pump operates the washer fluid to windshield immediately by washer nozzle. The washer pump operates once after 750 ms. If the switch is still ON, perform the lower speed wiper operation for three times, and the wipe operation will continue until the motor stops. The washer pump keeps working when the switch is

ON, even if the switch is OFF, it still operates three times, and then operates once again after a short delay. If other wiper functions is selected before finishing the programmed washer/wiper operation, it will be cancelled, causing the wiper to operate according to the new selected function.

Low Speed Operation

The power source is supplied to the wiper motor through two normal close relays of the wiper (start relay and speed relay). Both relay coils are controlled by the BCM. BCM circuit provides the start relay coil of the wiper with the ground connection when the low speed wiper operation mode is selected. The voltage is applied to the relay contact points by the start relay coil, in order to allow signals from fuse EFI in engine bay fuse box to transmit to start relay contact points. The signal is sent to the motor through the wiper relay and a resistor. The resistor makes the motor run in low speed by reducing the power supply. The motor ground device is grounded by the connecting the motor casing and ball joint. During intermittent wiper operation, BCM make the wiper operate in low speed by the resistance. When wiper is off, BCM converts the wiper relay to complete the cycle in low speed.

High Speed Operation

When high speed operation is selected, electronic switch will apply voltage to wiper start relay as in low speed operation. BCM can also apply voltage to wiper speed relay coil by using of another electronic switch in BCM to provide ground connection. The signal from fuse EFI, which passes through wiper relay contact point and then rounds the resistance that used for decelerating, is connected with motor directly, so that the wiper can operate at high speed.

Automatic (intermittent) Wiper Operation

Intermittent rotary switch can form a complete ground loop via the switch on BCM. Each switch corresponds to different resistances that monitored by BCM. BCM selects the appropriate timer according to the resistance value that has been measured to determine the delay time.

After BCM timer reaches a selected delay time, the wiper will operate once in low speed before it returns to the stop position. After that, BCM will turn on timer for another selected delay time before the following operation.

The correspondence between delay time and rotary switch position changes according to the position of wiper/washer lever switch and vehicle speed. When wiper/washer lever switch is in intermittent position, the correspondence of

vehicle speed, delay rotary switch position and the delay time (s) of the wiper blade is shown in the table below.

| Rotary Switch Position (resistance kΩ) | Vehicle Speed km/h (mph) | | | | | |
|---|--------------------------|-----------|-----------|-----------|------------|--------------|
| | <8 (<5) | <32 (<20) | <64 (<40) | <92 (<57) | <128 (<80) | ≥ 128 (≥ 80) |
| 0 | 8 | 6 | 5 | 4 | 3 | 3 |
| 1 (1-3) | 26 | 19 | 17 | 15 | 15 | 13 |
| 2 (3-5) | 7 | 12 | 11 | 10 | 9 | 7 |
| 3 (5-7) | 10 | 6 | 6 | 5 | 4 | 3 |
| 4 (7-9) | 5 | 3 | 3 | 2 | 2 | 2 |

When wiper/washer lever switch is in low speed position and the vehicle speed is lower than 8 km/h, the correspondence between the delay time of the wiper blade twice operation and the rotary switch position is shown in the table below.

| Rotary Switch Position (resistance kΩ) | Vehicle Speed km/h (mph) |
|---|--------------------------|
| | <8 (<5) |
| 0 | 8 |
| 1 (1-3) | 30 |
| 2 (3-5) | 26 |
| 3 (5-7) | 17 |
| 4 (7-9) | 10 |

Note: The rotary switch position 0 indicates the resistance detected by BCM is out of 1–9 KΩ, i.e. the rotary switch is in a wrong position. And the time delay for this position will only be applied in the next wiper delay cycle.

Return Switch

Return switch contains an incomplete control chip (on the worm gear inside the wiper motor). The motor, motor ground control chip and worm gear are connected together. Input

from BCM is connected with one contact point of the wiper motor; the motor and return control chip are connected together to complete ground connection in BCM when the wiper in the return position. Closed circuit will provide ground function for the output from BCM. BCM will interpret the ground signal into of the wiper in the stop position signal.

Windshield Washer

Once the programmed washer/wiper operation is on, a complete ground route will be formed through BCM and washer pump on single wire via switch. Closed ground loop sends requirement of programmed control washer/wiper operation to BCM, and operates wiper accordingly. When closed ground loop is formed, washer pump is turned on.

When wireless key is inserted or the ignition switch is turned on, the washer pump receives 12V power by fuse F21 in the passenger compartment fuse box and fuse EF30 in the engine bay fuse box. When programmed washer/wiper operation is selected by wiper arm switch, a ground loop is formed through switch and washer pump, and it will operate at that time. The washer pump operates at least 750 ms whenever the switch is ON.

Service Procedures

Windshield Wiper Blade Assembly

Removal

1. Lift the wiper blade from the windshield.
2. Press the setting clamp, and slide downward the wiper blade along the wiper arm and remove the blade simultaneously.

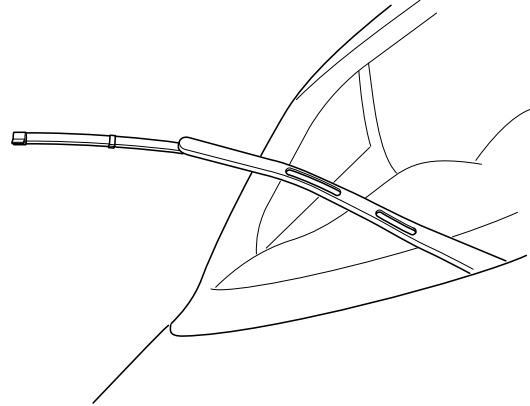
Refit

1. Slide the blade to the wiper until the setting clamp is engaged. Thus fit the blade.
2. Hold the wiper arm to the windshield.

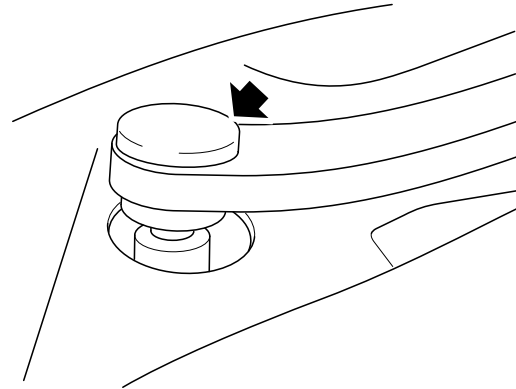
Windshield Wiper Arm Assembly

Removal

1. Open the bonnet.
2. Remove the wiper arm shaft cover to expose the wiper arm nut.



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3. Remove the nut fitting the wiper arm to the link mechanism.
4. Remove the wiper arm.

Refit

1. Fit the wiper arm.
2. Fit the nut to mandrel, and the torque is **20-30 Nm**.
3. Cover the wiper arm shaft cover.
4. Close the bonnet.

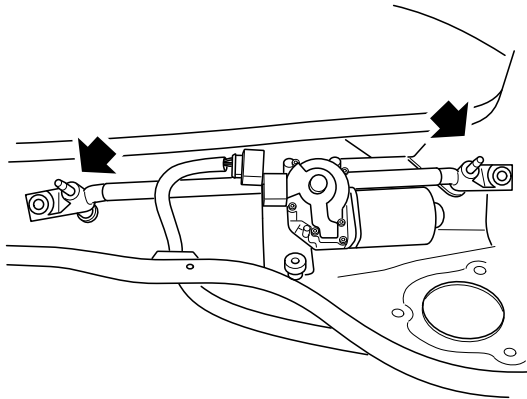
Windshield Wiper Link Mechanism Assembly - with Motor

Removal

1. Disconnect the battery negative terminal.
2. Remove the windshield wiper arm assembly.

Windshield Wiper Arm Assembly

3. Remove the air intake grille assembly.
4. Unscrew the bolts of the windshield wiper link mechanism assembly.



S960004

5. Remove the windshield.

Refit

1. Fit the windshield wiper link mechanism assembly with bolts, and the torque is **4-10 Nm**.
2. Fit the air intake grille assembly.
3. Fit the windshield wiper arm assembly.

Windshield Wiper Arm Assembly

4. Connect the battery negative terminal.

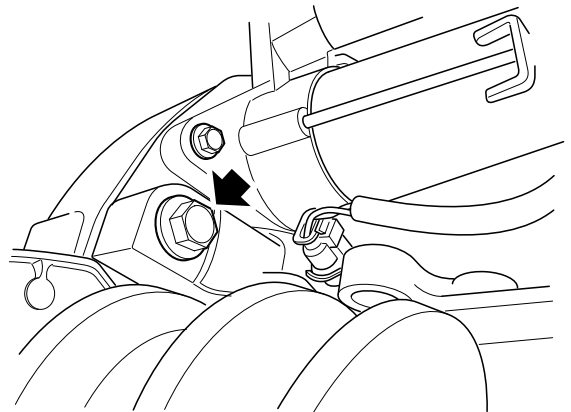
Windshield Wiper Motor

Removal

1. Disconnect the battery negative terminal.
2. Remove the windshield wiper arm assembly.

Windshield Wiper Arm Assembly

3. Remove the air intake grille assembly.
4. Remove the windshield wiper link mechanism assembly.



S960005

5. Remove the connector, motor and link mechanism from the windshield wiper motor.

Refit

1. Connect the connector to the windshield wiper motor.
2. Fit the motor and link mechanism with bolts.
3. Fit the air intake grille assembly.
4. Fit the windshield wiper arm assembly.

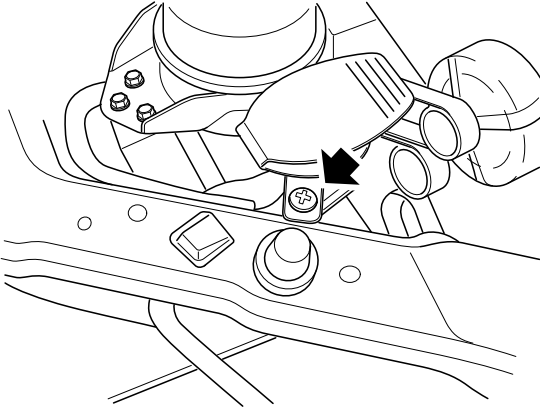
Windshield Wiper Arm Assembly

5. Connect the battery negative terminal.

Washer Fluid Reservoir Assembly

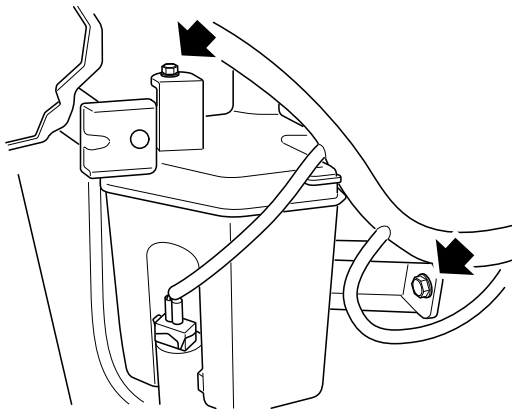
Removal

1. Disconnect the battery negative terminal.
2. Prepare a container that is used for collecting spilled fluid.
3. Loosen the snap fits from the engine bay wire to the washer fluid reservoir.



S960006

4. Unscrew the bolts positioning the washer fluid reservoir neck to the body, and remove the washer fluid reservoir neck from the washer fluid reservoir.
5. Remove the bolts securing the washer fluid reservoir to the body.



S960007

6. Disconnect the washer hose from the washer fluid reservoir.
7. Disconnect the washer pump connector and remove the washer fluid reservoir.

Refit

1. Hold the washer fluid reservoir to the body with bolts, and tighten them to **4-6 Nm**.
2. Connect the engine compartment wire to the washer fluid reservoir with snap fits.
3. Connect the washer pump electrical connector.
4. Connect the washer hose to the washer pump.
5. Connect the battery negative terminal.

Washer Pump Assembly

Removal

1. Disconnect the battery negative terminal.
2. Remove the washer fluid reservoir.

Washer Fluid Reservoir

3. Disconnect the washer hose from the washer fluid reservoir.
4. Disconnect the electrical connector.
5. Remove the washer fluid pump.

Refit

1. Connect the washer hose to the washer fluid pump.
2. Fit the washer fluid pump.
3. Connect the washer fluid reservoir.

Washer Fluid Reservoir

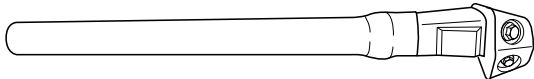
4. Connect the battery negative terminal.

Front Windshield Washer Nozzle**Removal**

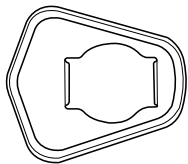
1. Open the bonnet.
2. Remove bonnet sound-insulating mat.

 **Bonnet Sound-insulating Mat**

3. Disconnect the washer hose from the nozzle.
4. Remove the washer nozzle and shim from the bonnet.



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S960009

Refit

1. Fit the shim and washer nozzle to the bonnet.
2. Connect the washer hose to the nozzle.
3. Fit bonnet sound-insulating mat.

 **Bonnet Sound-insulating Mat**

4. Cover the bonnet.

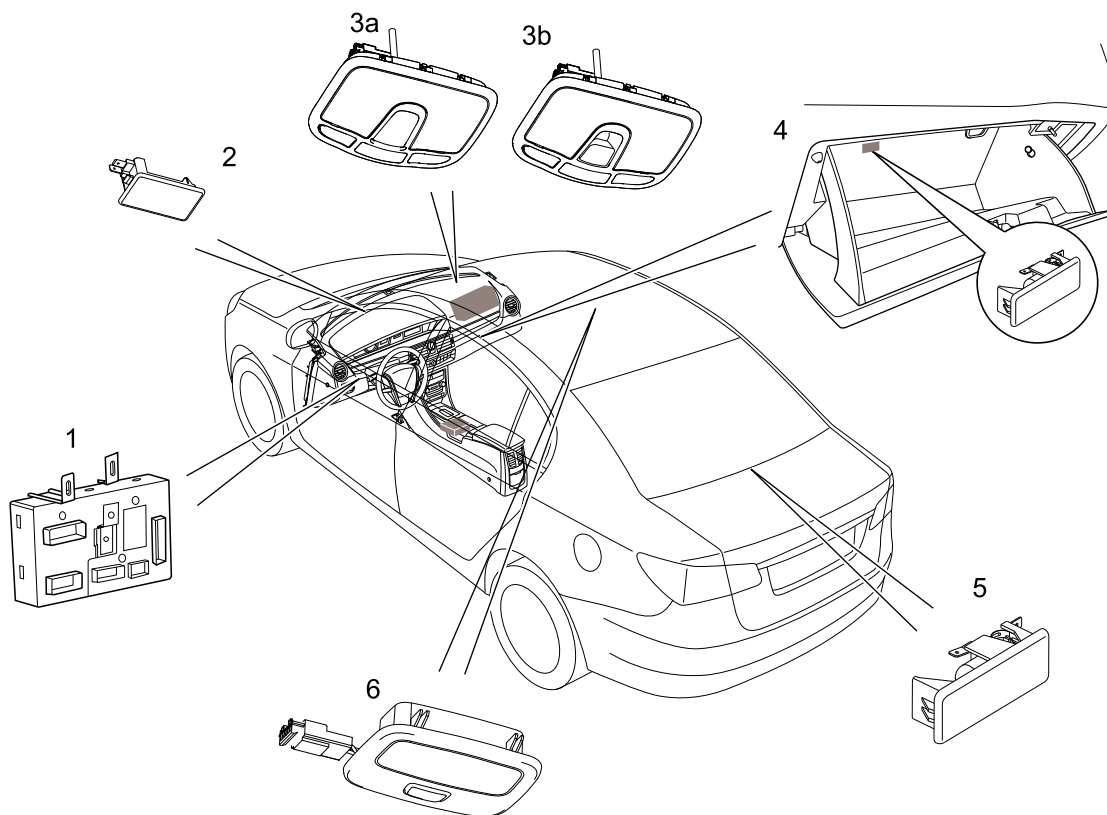
Lighting**Specifications****Torque**

| Description | Value |
|-------------------------------------|----------|
| Self-tapping Screw - Front Map Lamp | 1.5-2 Nm |
| Nut - Rear Map Lamp | 1.5-2 Nm |

Description and Operation

System Component Layout

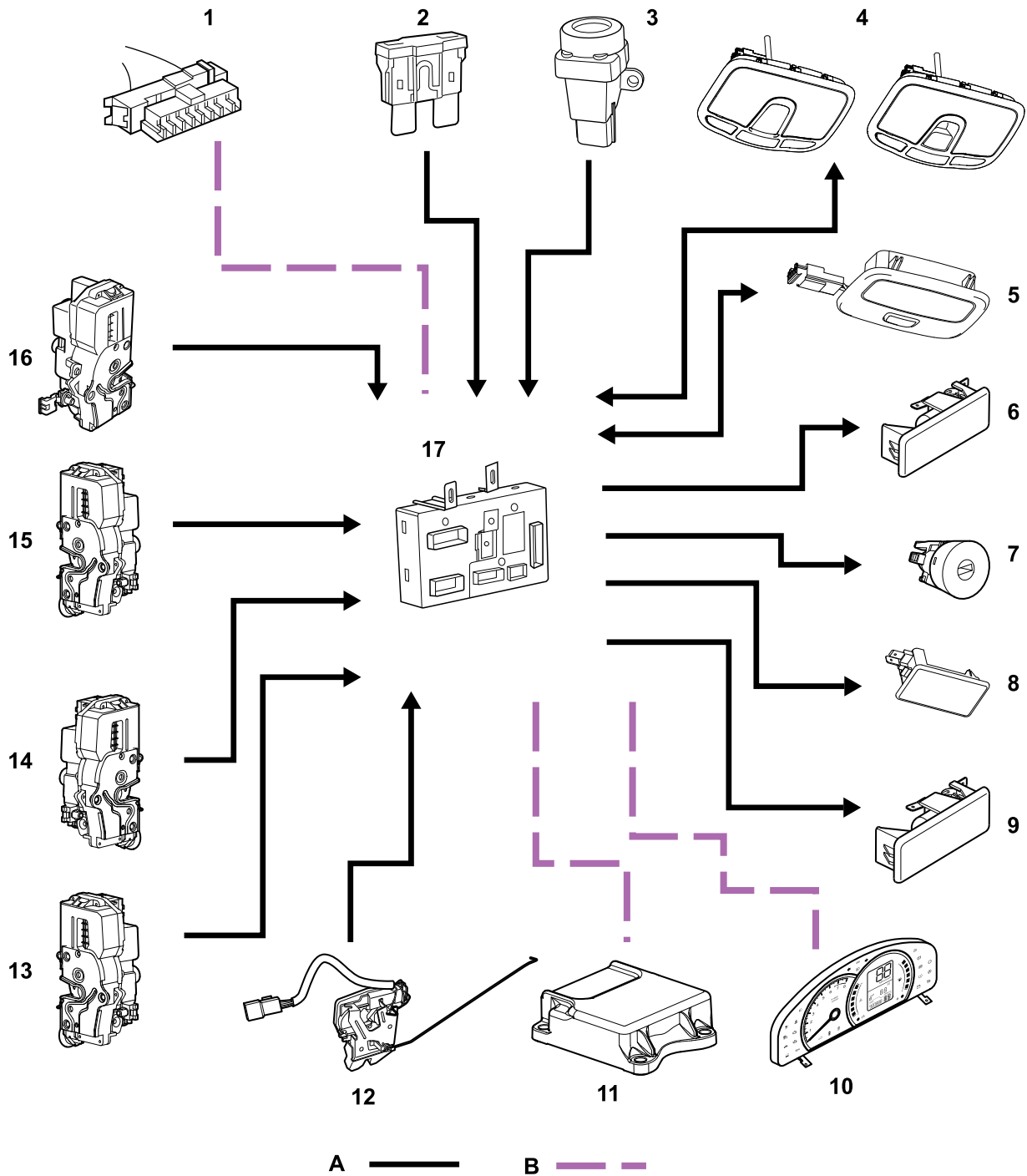
Interior Illumination Component Layout



S702000

- | | |
|---------------------------------------|--------------------|
| 1. Body Control Module (BCM) | 4. Glove Box Light |
| 2. Vanity Mirror Light (if equipped) | 5. Boot Light |
| 3. a. Front Map Lamp | 6. Rear Map Lamp |
| b. Front Map Lamp with Sunroof Switch | |

System Control Diagram
Interior Illumination Control Diagram



A = Hard Wire; B = High SpeedCAN Bus Line

- | | |
|----------------------------------|-------------------------------------|
| 1. Diagnostic Socket | 8. Vanity Mirror Light |
| 2. Passenger Compartment Fuse 12 | 9. Boot Light |
| 3. Inertia Switch | 10. Instrument Pack |
| 4. Front Map Lamp | 11. Airbag Control Module |
| 5. Rear Map Lamp | 12. Boot Lock Body Assembly |
| 6. Glove Box Light | 13. Rear Door lock Body Assembly RH |
| 7. Key Cylinder LED Illumination | 14. Rear Door lock Body Assembly LH |

15. Driver Side Door Lock Body Assembly

17. Body Control Module (**BCM**)

16. Front Passenger Side Door Lock Body Assembly

Description

General Description

The interior lighting system is controlled by the body control module (**BCM**) which is located behind the driver instrument panel.

The interior light system includes:

- Front Map Lamp
- Rear Map Lamp
- Glove Box Light (if equipped)
- Vanity Mirror Light (if equipped)
- Boot Light
- Instrument Panel and Key Cylinder **LED** Illumination

Front Map Lamp

The front map lamp is fitted on the roof inner garnish in the centre above the windshield. The assembly is secured with 2 screws that are fitted to the mounting bracket which is connected to the front header and secured on the ceiling with 3 spring clips and 2 solid clips.

The front map lamp assembly has a temporary operation switch and 2 self-lock switches to control the map lamp. The light is fitted on a plastic housing on which the sunroof switch and Bluetooth microphone of the on-board hands-free telephone system (if equipped) are located. The whole unit is connected to the roof wire using the 4-pin connector.

The front map lamp bulb is a single filament one. The front map lamp lens is made semitransparent to evenly illuminate the cabin.

The bulb can be replaced after removing the lens. The bulb can be fitted by pushing it into the bracket, and can be removed by pulling it gently.

Rear Map Lamp

The rear map lamp assembly is located in the centre of the rear part of the roof inner garnish. The assembly is secured on the ceiling and can be removed by prying it up from the ceiling carefully. The whole unit is connected to the roof wire using the 3-pin connector.

If the map lamp is fitted with two screws, you need to remove the lens to replace the bulb, and it can be removed with the screw being removed.

Boot Light

The boot light is located in the middle of the panel which is on the top of the boot. The outer section is a plastic housing

with the lens and light clamp inside. When the boot is open, the boot light operates automatically. The boot light is a single filament bayonet-coupled bulb.

Glove Box Light (if equipped)

The glove box light is located in the hole above the glove box RH. This light is connected to the 2-pin connector with the mini switch which is located outside the glove box RH, and operated by the glove box hinge mechanism.

When the glove box door is open, the glove box light comes on automatically. The glove box light bulb is a single filament one.

Vanity Mirror Light (if equipped)

The vanity mirror and vanity mirror light are fitted on the visors of the driver and passenger sides. There is a light on each side of the mirror, and illuminates through the semitransparent lens. The bulb can be removed by prying up the lens carefully. The vanity mirror light can be opened any time whatever status the ignition switch and the master light switch are in.

The vanity mirror light is connected to the roof wire through the 2-pin connector. When the vanity mirror cap is open, the simple switch driven by the tang of the cap closes the return circuit and turns on the vanity mirror light. The vanity mirror light has two 3 W bulbs which are colorized single filament.

Instrument Panel Back light Illumination

The instrument panel components, such as the instrument pack, wireless key cylinder and so on, are all provided with illumination by **LED**. The instrument panel lights control their brightness level through the pulse width modulation signal (**PWM**) as follows:

- After inserting the wireless key or turning on the ignition switch, the instrument panel light becomes brighter when the headlights or side marker lights are turned on.
- When the side marker lights are turned off, the instrument panel lights fade out.
- The instrument panel lights fade out after removing the wireless key.

Bulb Specification

| Light | Bulb Type | Voltage Power |
|-----------------|-----------|---------------|
| Glove Box Light | C5W | 12V 5W |
| Front Map Lamp | C10W | 12V 10W |
| Rear Map Lamp | C10W | 12V 10W |
| Boot Light | C5W | 12V 5W |

Operation

General Description

The interior illumination uses the power source from the battery, and is connected to the power source through No.37 fuse in the engine bay and No.12 fuse in the passenger compartment. If 15 minutes has elapsed since the room lamps are turned on (for example when the door is open or the door is locked by mistake), the interior illumination lights enter the **PWM** control mode and fade out until all the room lamps are turned off. If the vehicle is locked with the key, the **BCM** will turn off all the room lamps.

Interior Illumination

The interior illumination includes:

- Front Map Lamp
- Rear Map Lamp
- Glove Box Light (if equipped)
- Vanity Mirror Light (if equipped)
- Boot Light
- Instrument Panel and Key Cylinder **LED** Illumination

When the **BCM** receives signal from the front map lamp main switch, or the signal indicating that the door or trunklid is open or the vehicle is unlocked, the **BCM** illuminates the interior illumination lights.

PWM Control

The main switch on the front map lamp assembly can control the front and rear map lamps. The interior illumination lights controlled by the **PWM** are: the front and rear map lamps, boot light, instrument panel and wireless key cylinder **LED** illumination. If the door is open when the interior illumination lights come on, the **PWM** output will increase linearly to meet the requirement of the interior illumination and turns on the room lamps completely after approximately 1.3 seconds. And if the interior illumination is turned off (unless the ignition switch is at the "**AUX**" position and the side marker light is turned on), the **PWM** output will decrease linearly, and turns off the room lamps within approximately 2.8 seconds. If the interior illumination lights are illuminated when engine is started, all of them will be turned off immediately, and the illumination will be recovered automatically after starting is finished.

The related function operations are as follows:

- The front and rear map lamps fade in when pressing the unlock key on the wireless key or unlocking the door with the mechanical key, and fade out if no door is open within 30 seconds.
- The map lamps fade in after turning off the ignition switch, and the front and rear map lamps fade out if no door is open within 30 seconds.

- If the interior illumination lights are illuminated and the doors are all closed, the interior illumination light will fade out within 30 seconds when the ignition switch is turned from KL.R to the other position.
- The illumination lights fade out when pressing the lock key on the wireless key or locking the door with the mechanical key.
- The interior illumination lights fade out when all the doors are closed and the ignition switch is at the "**AUX**" position.
- The interior illumination lights fade out when all the doors are closed and the ignition switch is at the "ignition" position.
- Synchronous Control (Timed-Relay control)

The relay switch control is momentary. The interior illumination lights controlled by the relay switch are: the glove box light, vanity mirror light, and front and rear map lamps. When the ignition switch is at the "**AUX**" position, with the unlock key on the wireless key pressed or the door unlocked with the mechanical key, the **BCM** activates the synchronous control function of the relay for the front and rear map lamps.

The related function operations are as follows:

- The front and rear map lamps come on immediately when pressing the switches of the lamps.
- When opening the glove box, the glove box light, controlled by the linked switch, comes on immediately.
- When opening the vanity mirror cap, the simple switch driven by the tang of the cap closes the return circuit and turns on the vanity mirror light.

The **BCM** can make the Timed-Relay function control the front and rear map lamps in such conditions as follows:

- When the ignition switch is at the "**AUX**" position.
- When pressing the unlock key on the wireless key or unlocking the door with the mechanical key.

The **BCM** can not make the Timed-Relay function control the front and rear map lamps in such conditions as follows:

- When 15 minutes has elapsed after turning off the ignition switch.
- When pressing the lock key on the wireless key or locking the door with the mechanical key.
- When the vehicle lock system is in the external lock condition.
- When the ignition switch is at the "start" position.

Inertia Switch Operation

If the inertia switch is activated or the collision signal is received by the collision sensor when the collision of vehicle has happened, the **BCM** will turn on all the interior illumination

lights (the lights are on for at least 15 minutes) immediately, cut off the power source of the fuel pump, and unlock the door (if the door has been locked). When resetting the inertia switch, the **BCM** turns off all the interior illumination lights.

Instrument Panel Back Light Illumination and Dimming

The LED supplies illumination for all the switches, panels, key cylinder and the instrument panel. When rotating the master

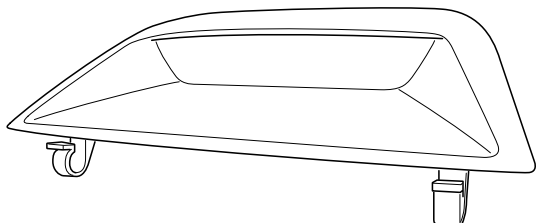
light switch to the position of the side marker light or headlight, the **BCM** supplies the power source for the **LED**. All the **LED** illumination is controlled by the **PWM**.

Service Procedures

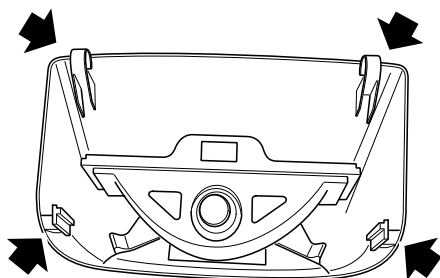
High Mounted Stop Lamp Assembly

Removal

1. Disconnect the battery negative terminal.
2. Press out the high mounted stop lamp clamp.



S101001



S101002

3. Remove the high mounted stop lamp assembly.
4. Disconnect the electrical connector.

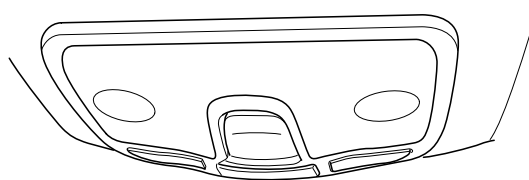
Refit

1. Connect the electrical connector.
2. Press the high mounted stop lamp assembly into the parcel shelf with the high mounted stop lamp assembly clamp.
3. Connect the battery negative terminal.

Front Map Lamp Assembly

Removal

1. Disconnect the battery negative terminal.
2. Remove the map lamp glass cover.
3. Remove the screws, map lamp and map lamp clamp.



S101003

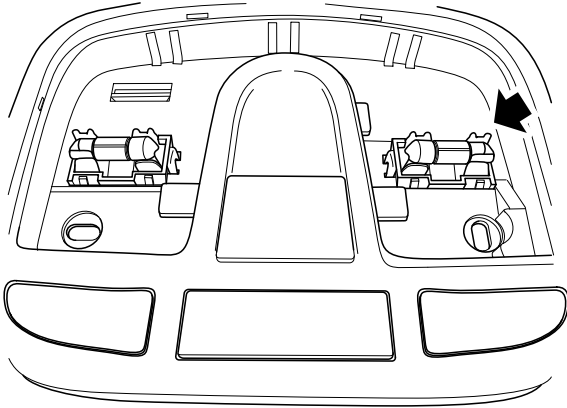
4. Disconnect the electrical connector.

Refit

1. Connect the electrical connector.
2. Fit the map lamp clamp, map lamp and screws, and tighten the screws to **1.5-2 Nm**.
3. Fit the map lamp glass cover.
4. Connect the battery negative terminal.

Front Map Lamp Bulb**Removal**

1. Disconnect the battery negative terminal.
2. Remove the front map lamp glass cover.
3. Remove the front map lamp bulb.



S101004

Refit

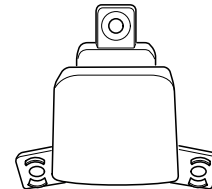
1. Fit the front map lamp bulb.
2. Fit the front map lamp glass cover.
3. Connect the battery negative terminal.

Sunroof Switch Set**Removal**

1. Disconnect the battery negative terminal.
2. Remove the front map lamp assembly.

 **Front Map Lamp Assembly**

3. Remove the sunroof switch set.



S101005

Refit

1. Remove the sunroof switch reserve set.
2. Fit the screws and sunroof switch set.
3. Connect the electrical connector.
4. Fit the front map lamp assembly.

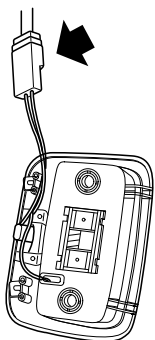
 **Front Map Lamp Assembly**

5. Connect the battery negative terminal.

Rear Map Lamp Assembly

Removal

1. Disconnect the battery negative terminal.
2. Press out the rear map lamp clamp.
3. Remove the rear map lamp assembly.
4. Disconnect the electrical connector.



S101006

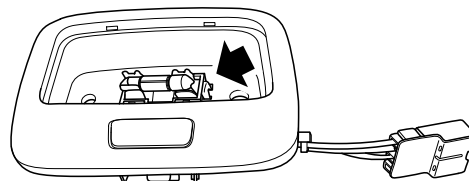
Refit

1. Connect the electrical connector.
2. Press the rear map lamp assembly into the ceiling with the rear map lamp clamp, and secure it with nuts and tighten the nuts to **1.5-2 Nm**.
3. Connect the battery negative terminal.

Rear Map Lamp Bulb

Removal

1. Disconnect the battery negative terminal.
2. Remove the rear map lamp assembly.



S101007

Rear Map Lamp Assembly

3. Remove the rear map lamp glass cover.
4. Remove the rear map lamp bulb.

Refit

1. Fit the rear map lamp bulb.
2. Fit the rear map lamp glass cover.
3. Fit the rear map lamp assembly.

Rear Map Lamp Assembly

4. Connect the battery negative terminal.

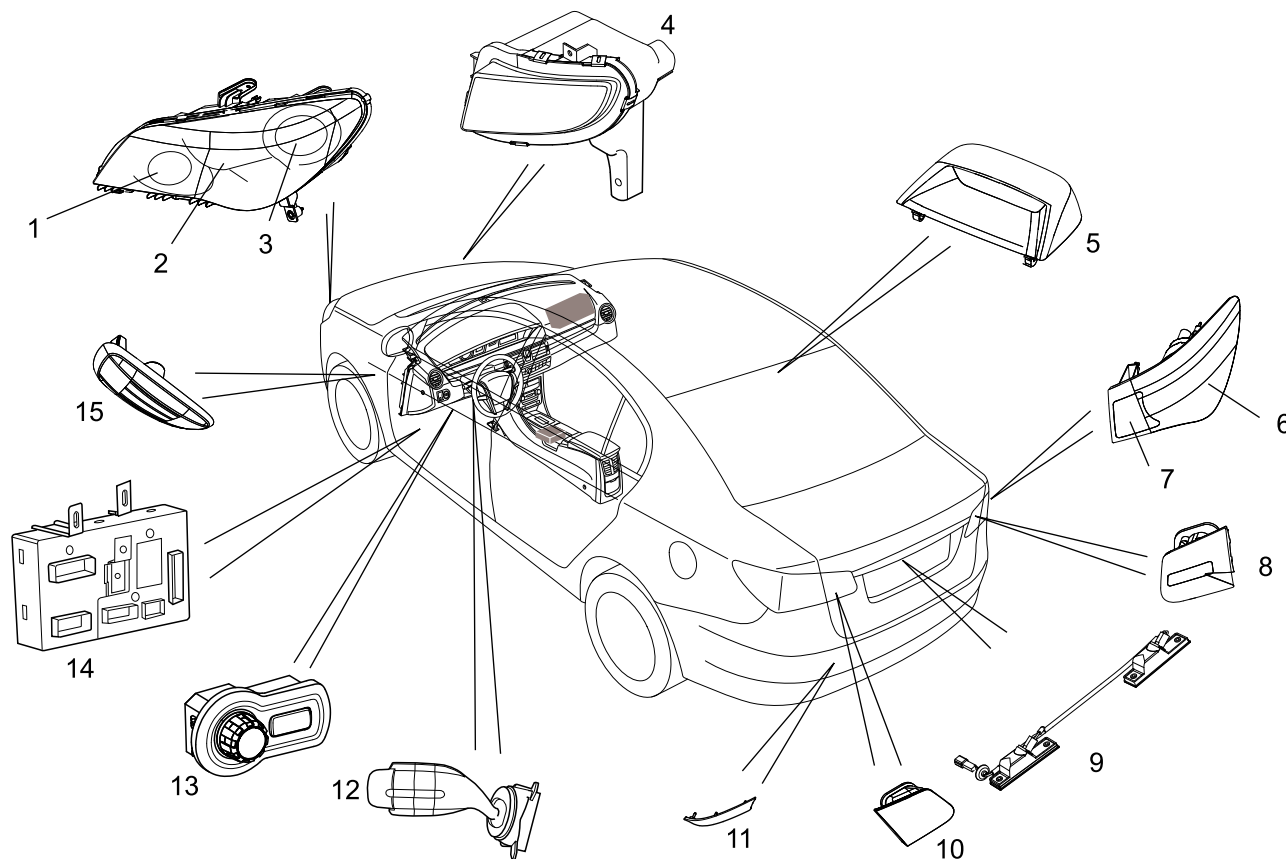
Lamps**Specifications****Torque**

| Description | Value |
|------------------------------------|------------|
| Bolt - Hexagon Head Bolt with Shim | 6-10 Nm |
| Flange Nut M5 - Taillamp | 2.7-3.3 Nm |

Description and Operation

System Component Layout

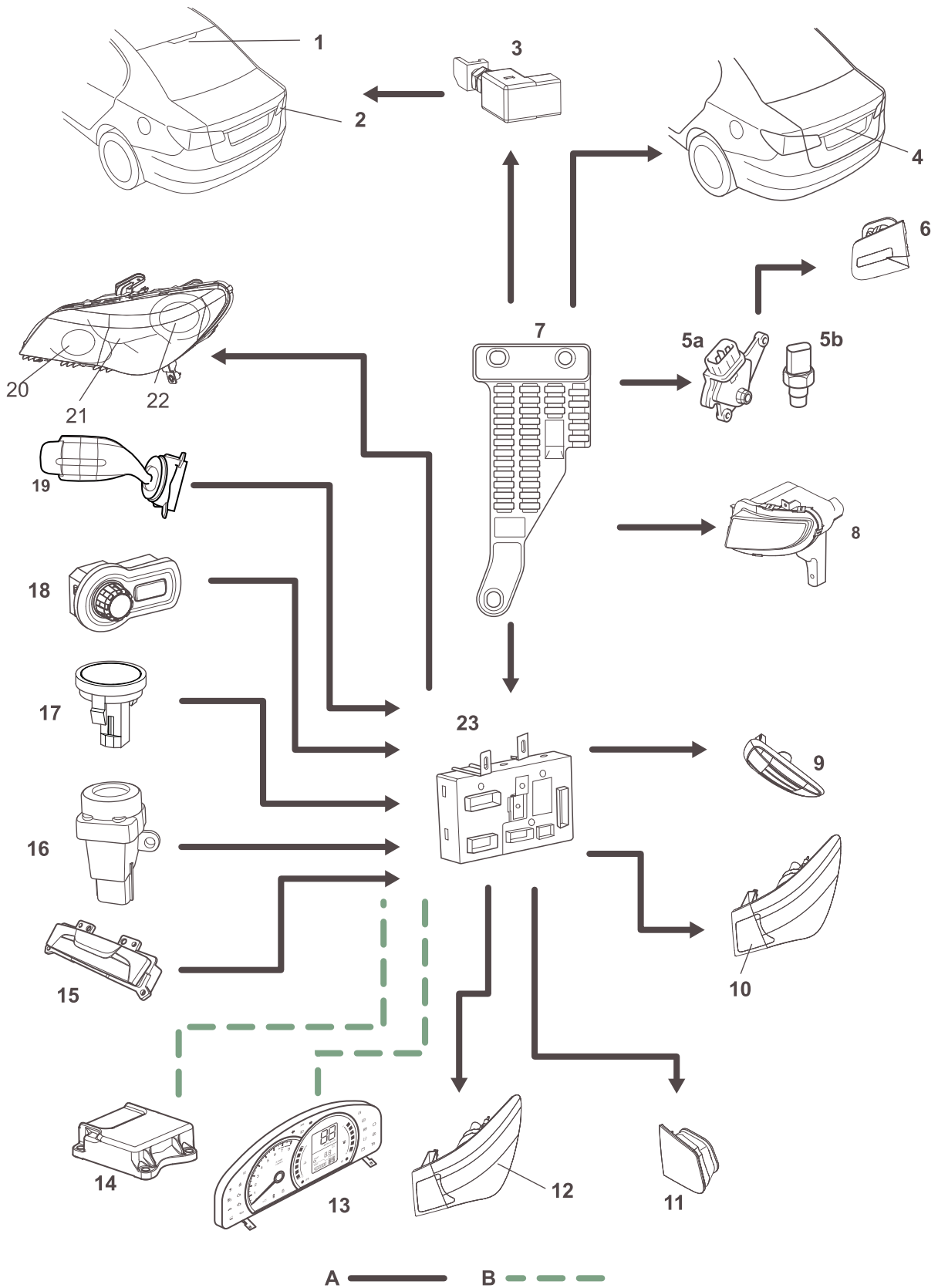
Exterior Illumination Component Layout



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- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Main Beam Lamp and Side Marker Light 2. Front Direction Indicator 3. Dipped Beam Lamp 4. Front Fog Lamp 5. High Mounted Stop Lamp 6. Taillamp 7. Rear Direction Indicator 8. Back-Up Light | <ul style="list-style-type: none"> 9. Rear License Plate Lamp 10. Rear Fog Lamp 11. Reflex Reflector 12. Direction Indicator/Main Beam Lamp Lever Switch 13. Master Light Switch (MLS) 14. Body Control Module (BCM) 15. Side Direction Indicator |
|--|--|

System Control Diagram
Exterior Illumination Control Diagram



A = Hard Wire; B = Medium SpeedCAN Bus Line; C =LIN Bus Line

1. High Mounted Stop Lamp
2. Stop Lamp
3. Brake Switch
4. Rear License Plate Lamp
5. a. Reverse Switch (Auto)
b. Reverse Switch (Manual)
6. Back-Up Light
7. Engine Bay Fuse Box
8. Front Fog Lamp
9. Side Direction Indicator
10. Rear Direction Indicator
11. Rear Fog Lamp
12. Taillamp
13. Instrument Pack
14. Airbag Control Module
15. Hazard Warning Light Switch
16. Inertia Switch
17. Solar Sensor
18. Headlight Horizontal Adjusting Switch
19. Direction Indicator/Main Beam Lamp Lever Switch
20. Main Beam Lamp
21. Side Light/Front Direction Indicator
22. Dipped Beam Lamp
23. Body Control Module (**BCM**)

Description

General Description

The exterior lighting system includes the various exterior lights which are controlled by the master light switch and the automatic light control sensor. The exterior lighting system includes:

- Side Marker Light
- Taillamp
- Dipped Beam Lamp
- Main Beam Lamp
- Rear License Plate Lamp
- Stop Lamp/High Mounted Stop Lamp
- Direction Indicator/Side Turn Signal Light
- Front Fog lamp
- Rear Fog Lamp
- Back-Up Light

Master Light Switch (MLS)

1. Illumination Mode Select Switch
2. Instrument Panel Back Light Dimming Thumbwheel

The master light switch back light is always on after inserting the wireless key or turning on the ignition switch. If the side marker light or headlight is turned on during nighttime driving, the instrument panel illumination dims automatically to prevent the driver from being dazzled.

Automatic Light Control Sensor

The automatic light control sensor is integrated in the rain sensor and fitted on the windshield behind the inner rear view mirror.

Headlight

The headlight is fitted on the modular front end panel with screws. The headlight assembly includes the dipped beam lamp, main beam lamp and side marker lights.

The bulbs of the dipped beam lamp and main beam lamp are halogen bulbs, and a smaller bulb near the main beam lamp bulb is used for the side marker light illumination. There is a light foot on each halogen bulb to ensure that the bulb is fitted correctly. The rear of the headlight assembly is covered with sealed rubber membrane to keep off water and dust.

Side Marker Light and Taillamp

The side marker light is fitted near the main beam lamp. The side marker light bulb is a single filament one. The taillamp bulb is fitted on the bulb clamp behind the taillamp lens.

Rear License Plate Lamp

The two rear license plate lamps are secured at the lower side of the trunklid garnish with screws.

Direction Indicator

The front direction indicator is located in the middle area of the headlight assembly, the rear direction indicator is located at the lower side of the taillamp assembly and near the inner side, and the side turn signal lights are fitted on the front fender. The direction indicators have semitransparent lens and single filament orange bulbs.

Direction Indicator/Main Beam Lamp Lever Switch

The direction indicator/main beam lamp lever switch is on the left side of the steering column, and is used to control the following components:

- Left Turn Signal Light
- Right Turn Signal Light
- Headlight Blinking
- Dipped Beam Lamp/Main Beam Lamp Change
- On-Board Computer

Stop Lamp, High Mounted Stop Lamp (CHMSL) and Stop Lamp Switch

The stop lamp bulb is located in the lower area outside the taillamp assembly. It is a double filament bayonet bulb. The bulb protrudes from the corresponding taillamp lens, illuminating the stop lamp area. The bulb clamp can be removed from the device by simply removing the inner garnish in the luggage room rear side cornering and pushing the adjusting plate.

The high mounted stop lamp is secured on the parcel shelf fixed on the body through the snap fit of the light body. The bulb of this light is 16 W.

The stop lamp switch is connected to the pedal fixing bracket behind the instrument panel. The stop lamp switch which is a Hall-effect proximity sensor is activated by the tang on the upper part of the brake pedal.

The brake pedal is fitted on the pivot of the engine bay baffle upper pedal fixing bracket. The vacuum booster input rod is connected to the brake pedal with the pin of the rod and clevis. The tang on the end of the brake pedal activates the "instantaneous disconnection" Hall-effect stop lamp switch of the pedal fixing bracket.

The brake light switch includes a built-in sensor located in the outer mounting spool. The sensor is connected to the mounting boot which is connected to the pedal mounting bracket to ensure the correct position. The built-in sensor stays in the right position in the spool due to the serration interacting between the mounting spool and the sensor. For the sake of security, the brake light switch includes two independent circuits, and one is normal open while the other is normal close. For the information of the two circuits, refer to the "Brake Main Signal" and "Brake Security Signal".

Front Fog Lamp

The front fog lamp is located on the front bumper. In each front fog lamp, there is a halogen bulb which is powered by the relay in the engine bay fuse block. The fuse in the fog lamp circuit is also located in the engine bay fuse block.

Rear Fog Lamp

The rear fog lamp is fitted on the trunklid. The rear fog lamp bulb is fitted behind the taillamp lens of the trunklid. It is a single filament bayonet bulb. The bulb protrudes from the gap of the taillamp lens, illuminating the rear fog lamp lens area.

Back-Up Light

The back-up light bulb is located at the upper area inside the taillamp assembly. It is a single filament bayonet bulb.

The back-up light relay integrated in the **BCM** is connected to the back-up light switch. For vehicles equipped with the manual transmission unit, the back-up light switch is fitted behind the transmission case. For vehicles equipped with the automatic transmission unit, the back-up light switch is fitted in the neutral start switch.

Bulb Specification

| Light | Bulb Type | Voltage Power |
|-------------------------------------|-----------|---------------|
| Main Beam | H7 | 12V 55W |
| Dipped Beam | H7 | 12V 55W |
| Direction Indicator | PY21W | 12V 21W |
| Side Marker Light | W5W | 12V 5W |
| Back-Up Light | W16W | 12V 16W |
| Brake Light, Rear Side Marker Light | P21/5W | 12V 21W/5W |
| Direction Indicator | PY21W | 12V 21W |
| Front Fog Lamp | H8 | 12V 35W |
| Rear Fog Lamp | P21W | 12V 21W |
| Side Direction Indicator | WY5W | 12V 5W |
| License Plate Light | W5W | 12V 5W |

Operation

General Description

BCM controls the following exterior illumination lights:

- Dipped Beam Lamp
- Main Beam Lamp
- Rear Fog Lamp
- Side Marker Light/Taillamp
- Rear License Plate Lamp

BCM monitors the following exterior illumination lights:

- Back-Up Light
- Front Fog Lamp
- Stop Lamp

BCM controls and monitors the following exterior illumination lights:

- Direction Indicator (Excluding Side Direction Indicator)
- Hazard Warning Light

Direction Indicator, Parking Light, Hazard Warning Light

Direction Indicator

When the ignition key is in the auxiliary position and the steering switch is in the left or right blinking position, the corresponding direction indicator blinks in the frequency of 1:1.

The direction indicator still keeps on at the moment of ignition.

The various status information of the direction indicator informs the driver through the direction indicator and acoustic reminder device located on the instrument panel.

Direction Indicator Malfunction Monitoring (Excluding Side Direction Indicator)

BCM monitors the malfunction status of the direction indicator bulb, such as the open or short circuit, through the inner circuit. When one of the direction indicators in the chosen direction is malfunctioning, the **BCM** will control the light on that side to blink at a double frequency to inform the driver.

Hazard Warning Light

The hazard warning light is composed of all of the direction indicators, and keeps working when the battery is working.

The hazard warning light is controlled by the point-touch switch, the light starts blinking when the hazard warning light switch is touched for the first time, and it will go out when the switch is touched for the second time.

BCM direction indicator and the hazard warning light have the priorities as follows:

If the steering switch is turned on again when the hazard warning light is turned on, it will be switched to the direction indicator mode immediately. If the steering switch is turned off again or the ignition switch is turned off, the hazard warning light control will be resumed.

If the hazard warning light switch is turned on during the steering system operation, the hazard warning light mode will replace the steering system operation mode immediately. If the hazard warning light switch is touched once again, the direction indicator operation mode will be resumed.

If the **BCM** receives the hazard warning signal from the **CAN** bus line, it will control all the direction indicators operation and continues for at least 5 seconds, the lights will work in the hazard warning light mode.

Hazard Warning Light Blinking Continuously Under Collision Conditions

The **BCM** activates the hazard warning light automatically and the light blinks continuously when the collision signal is detected. The hazard warning light can be turned off only after touching the hazard warning light switch for at least 5 seconds, this is to prevent the hazard warning light switch from being touched by mistake under collision.

The **BCM** activates the hazard warning light automatically when the signal indicating the inertia switch is released is detected. The hazard warning light can be turned off only after touching the hazard warning light switch for at least 5 seconds, this is to prevent the hazard warning light switch from being touched by mistake under collision. Even if the inertia switch is reset at this time, the hazard warning light won't go out until the hazard warning light switch is pressed.

Rear Fog Lamp

With the ignition switch and front fog lamp knob on (ON), the rear fog lamp can only be turned on when the rear fog lamp switch is turned on. The output of the power source of the rear fog lamp and the instrument panel back light display light is controlled by the **BCM**.

If the conditions for turning off the rear fog lamp switch or turning on the ignition switch and turning on the switches of the headlight or the front fog lamp are not met, the rear fog lamp will be turned off.

The rear fog lamp which is turned on remains on at the moment of starting the engine.

Side Marker Light/Taillamp, License Plate Lamp

The side marker light/taillamp and license plate lamp are controlled by the same output interface of the **BCM**. When the knobs of the headlight and side marker light move to the side marker light position, the **BCM** can detect the signal indicating the side marker light/taillamp and license plate lamp are on, and then outputs a signal to open an exterior relay to

illuminate the side marker light/taillamp and the license plate lamp simultaneously.

Parking Light

The function of the parking light is to keep the side marker light LH or RH and taillamp on after the driver leaves the vehicle. This selection is completed by moving the direction indicator lever up or down as necessary when removing the ignition key. Under this condition, the instrument panel illumination lights remain off. This function is stopped after moving the direction indicator lever to the off position.

Dipped Beam Lamp

The dipped beam lamp operates when the knobs of the exterior light lever, headlight and side marker light are moved to the headlight position, and the ignition switch is turned on. It is controlled by the **BCM** through its inner relay.

Main Beam Lamp

The main beam lamp operates only with the dipped beam lamp on. The main beam lamp is turned on by pushing the exterior light lever to the direction away from the steering wheel (Be moved to the main beam lamp on position). The blinking function of the direction indicators and headlights is controlled by pulling the exterior light lever switch towards the steering wheel. The headlight remains on until the knobs of the headlight and side marker light are rotated to off position.

If the engine is not running before the ignition switch is turned on, the power source of the main beam lamp is cut off to ensure the starter motor can obtain the maximum current when starting the engine.

Position Lamp

The function of the position lamp is used for the the dipped beam lamp/rear fog lamp timer on the vehicle to illuminate the area around the vehicle and help the user find the vehicle in darkness. This function can be programmed with the function menu in the instrument unit. The menu allows the user to select the following options:

- Automatic illumination only for the dipped beam lamp.
- Automatic illumination only for the rear fog lamp.
- Automatic illumination for the dipped beam lamp and rear fog lamp.
- The delay of light off (0-5 minutes, the increment is 30 seconds).

If an effective unlock requirement of the vehicle is received and the automatic light control sensor confirms that the illumination level around is low, the **BCM** will turn the related lights on and maintain the fixed time for the lights to be on. If the position of the wireless key or the master light switch is changed, the position lamp function will be cancelled. This function can not be cancelled by opening any door.

The side marker light operation will not be affected by the position lamp function. When this function is enabled, if the side marker light is on, it keeps on during the time keeping of the timer until the time is up.

Front Fog Lamp

The front fog lamp operates when the knob of the exterior light lever switch is moved to the on position of the side marker light or headlight, and the ignition switch is on. If the knobs of the headlight and side marker light are returned to the original lock position (OFF), or the ignition key is moved to the auxiliary (**AUX**) position or removed, the front fog lamp will be off. The front fog lamp signal light illuminates in the instrument unit to inform the driver as long as the front fog lamp is turned on.

If the fog lamp is operated before starting the engine, the light will go out during the engine starting to ensure the starter motor obtains the maximum current.

Back-Up Light

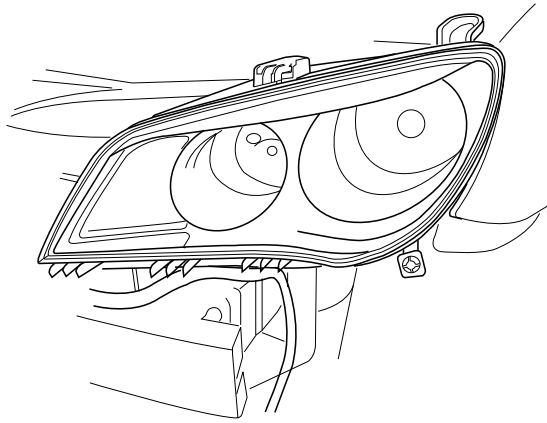
The back-up light illumination is controlled by a separate relay, not by the **BCM**. When the back-up light switch is turned on or off, the back-up light comes on or goes out.

Stop Lamp (Including two Rear Stop Lamps and High Mounted Stop Lamp)

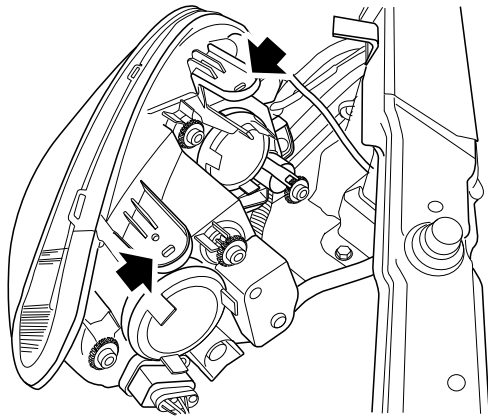
When the brake pedal is not used, the tang on the brake pedal leans on the end of the sensor laying idle. When the brake pedal is pressed, the tang is moved away from the sensor, causing the sensor output voltage to change. There are two pedal status level output in the stop lamp switch (double way hard wire output), received by the **ECM**. The **12V** power supply is on with the brake pedal pressed, to illuminate all the stop lamps. The **BCM** receives the brake signal via the **CAN** bus line from the **ECU**.

Service Procedures**Headlight Assembly****Removal**

1. Disconnect the battery negative terminal.
2. Remove the front bumper.
3. Remove the headlight mounting nuts and bolts.



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S102002

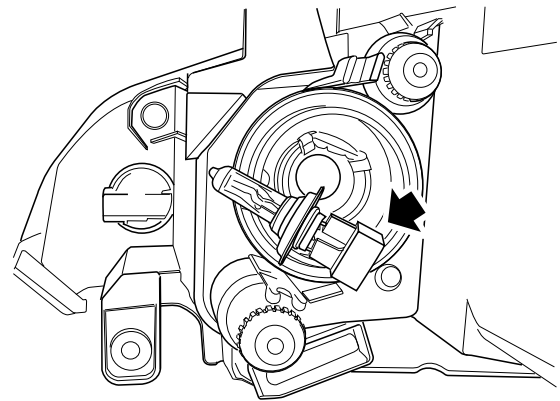
4. Pull the plug under the headlight out by the way.
5. Remove the headlight assembly.
6. Disconnect the electrical connector.

Refit

1. Connect the electrical connector.
2. Insert the plug under the headlight into the body frame.
3. Fit the headlight assembly with bolts and nuts, and tighten them to **6-10 Nm**.
4. Fit the front bumper.
5. Connect the battery negative terminal.

Headlight Bulb**Removal**

1. Disconnect the battery negative terminal.
2. Remove the front bumper.
3. Remove the headlight mounting nuts and bolts.
4. Pull the plug under the headlight out by the way.
5. Remove the headlight assembly.
6. Disconnect the electrical connector.
7. Remove the bulb in the direction indicated by the arrow.



S102003

Refit

1. Fit the bulb in the direction indicated by the arrow.
2. Connect the electrical connector.
3. Fit the headlight assembly with nuts and bolts.
4. Fit the front bumper.
5. Connect the battery negative terminal.

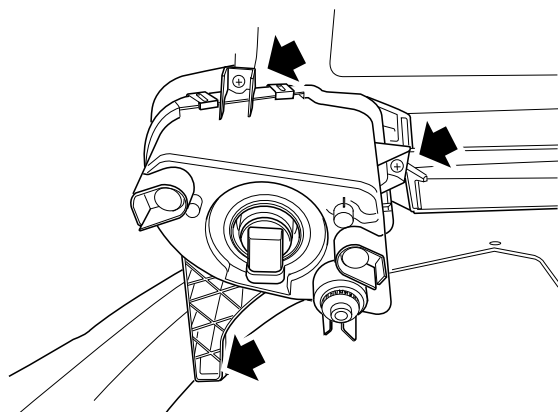
Front Fog Lamp and Turn Combination Light Assembly

Removal

1. Remove the front bumper.

Front Bumper

2. Disconnect the electrical connector.
3. Remove the 3 screws securing the front fog lamp to the front bumper assembly.



S102004

4. Remove the front fog lamp from the front bumper.

Refit

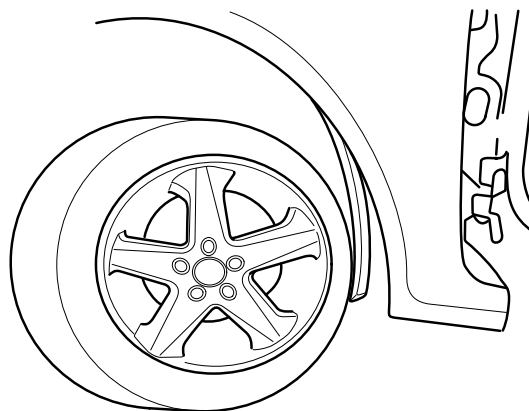
1. Fit the front fog lamp to the front bumper.
2. Fit and tighten the screws securing the front fog lamp to the front bumper.
3. Connect the electrical connector.
4. Fit the front bumper.

Front Bumper

Side Direction Indicator Assembly

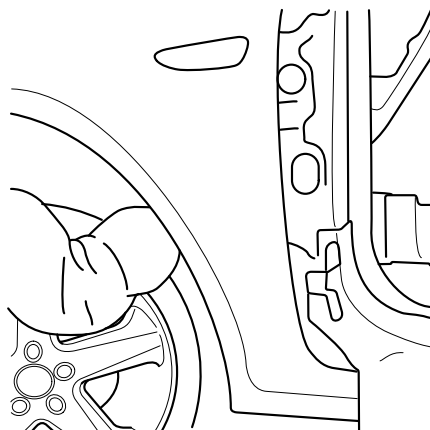
Removal

1. Disconnect the battery negative terminal.
2. Deviate the wheels and remove part of the splash shield.



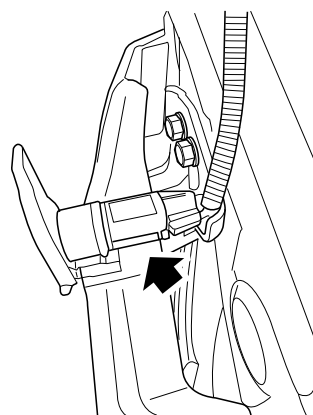
S102017

3. Put your hand behind the front fender and press the spring plate behind the light body.



S102018

4. Remove the side direction indicator.
5. Disconnect the electrical connector.



S102006

Refit

1. Connect the electrical connector.
2. Fit the side direction indicator.
3. Connect the battery negative terminal.

Side Direction Indicator Bulb**Removal**

1. Disconnect the battery negative terminal.

 **Side Direction Indicator Assembly**

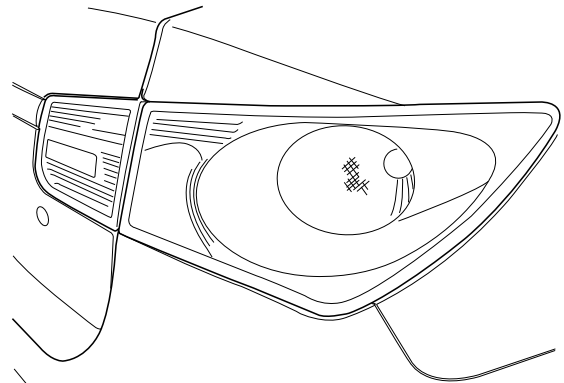
2. Rotate the bulb socket in the direction indicated by the arrow.
3. Remove the side direction indicator bulb from the socket.

Refit

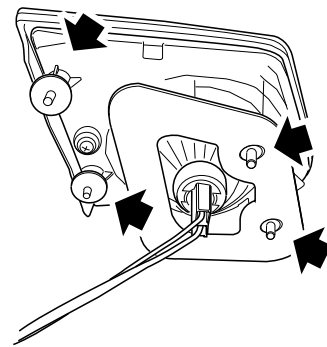
1. Insert the side direction indicator bulb into the socket.
2. Fit the socket to the side direction indicator assembly.
3. Fit the side direction indicator assembly.

 **Side Direction Indicator Assembly**
Taillamp Assembly**Removal**

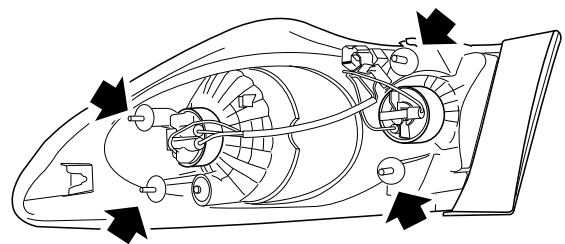
1. Disconnect the battery negative terminal.
2. Remove the screws of the taillamp assembly.



S102007



S102008



S102009

3. Slide the taillamp assembly towards the end of the vehicle and remove the taillamp assembly.
4. Disconnect the electrical connector.
5. Remove the clamp of the taillamp assembly.

Refit

1. Fit the clamp of the taillamp assembly.
2. Connect the electrical connector.
3. Fit the nuts of the taillamp assembly and tighten them

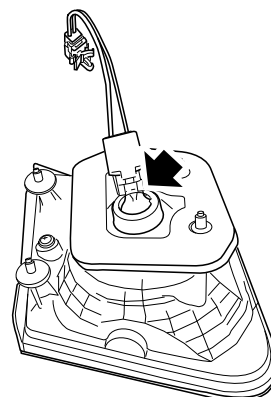
to 2.7-3.3 Nm.

4. Connect the battery negative terminal.

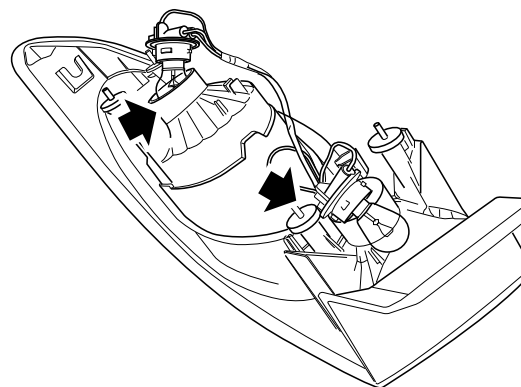
Taillamp Assembly Bulb

Removal

1. Disconnect the battery negative terminal.
2. Remove the nuts and light assembly.



S102010



S102011

Taillamp Assembly

3. Rotate the bulb in the direction indicated by the arrow to remove it.

Refit

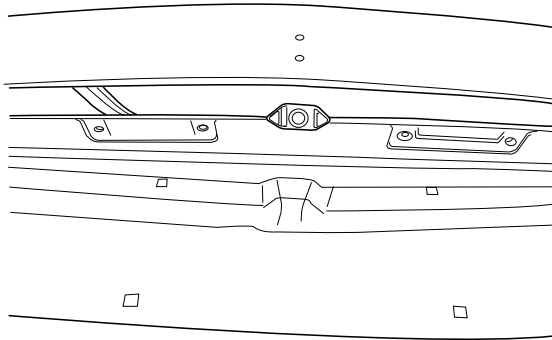
1. Rotate the bulb in the direction indicated by the arrow to fit it.
2. Fit the light assembly with nuts.

Taillamp Assembly

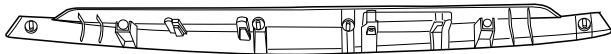
3. Connect the battery negative terminal.

Rear License Plate Light Assembly**Removal**

1. Disconnect the battery negative terminal.
2. Remove the nuts.



S102012



S102013

3. Remove the rear license plate light assembly
4. Disconnect the electrical connector.

Refit

1. Connect the electrical connector.
2. Beat the rear license plate light assembly clamp into the trunk lid.
3. Fit the nuts.
4. Connect the battery negative terminal.

Rear License Plate Light Bulb**Removal**

1. Disconnect the battery negative terminal.
2. Remove the screws and rear license plate light assembly.



S102014

Hand icon **Rear License Plate Light Assembly**

3. Disconnect the electrical connector.
4. Rotate the bulb socket in the direction indicated by the arrow.
5. Remove the rear license plate light bulb from the socket.

Refit

1. Fit the rear license plate light bulb.
2. Press the rear license plate light socket into the rear license plate light assembly.
3. Connect the electrical connector.
4. Fit the screws and the rear license plate light assembly.

Hand icon **Rear License Plate Light Assembly**

5. Connect the battery negative terminal.

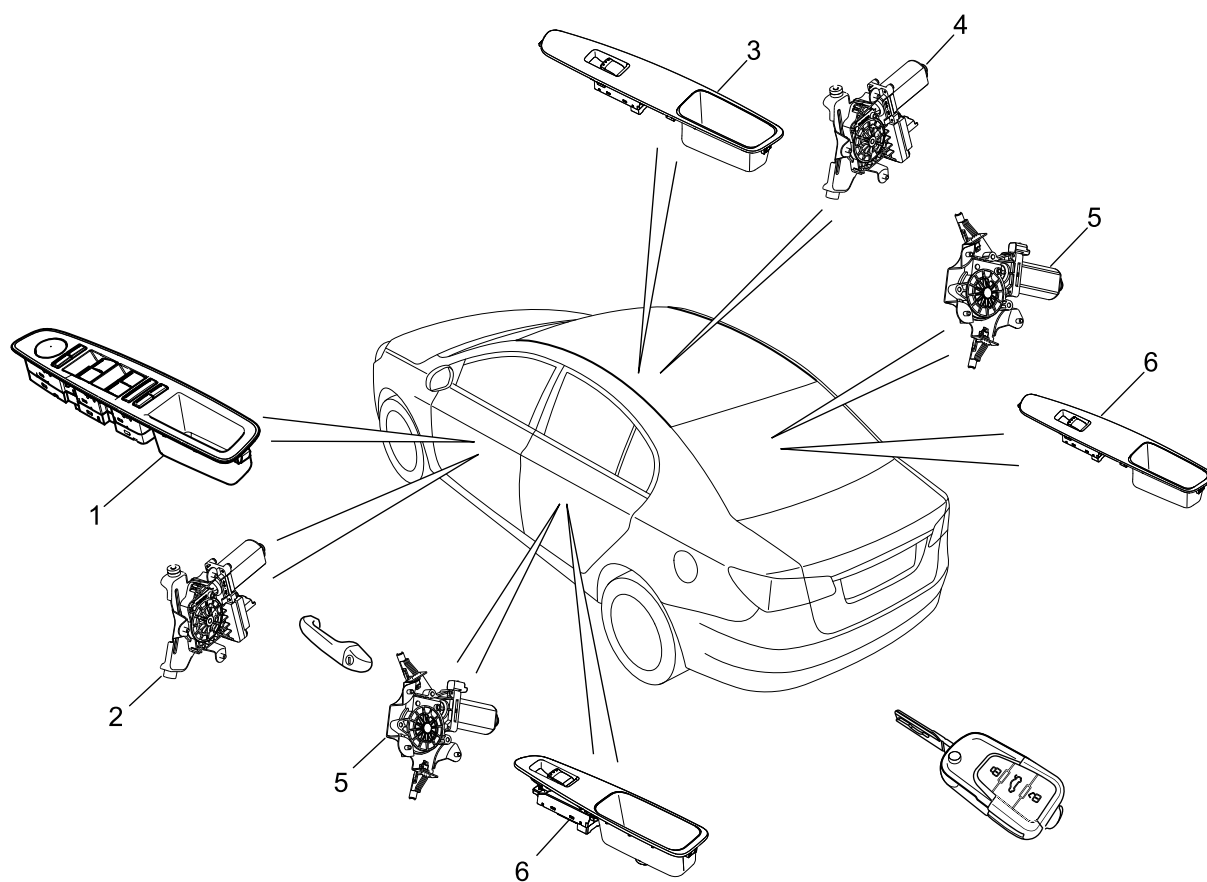
Doors
Specifications
Torque

| Description | Value |
|---|------------|
| Bolt - Door Hinge Bolt Door Side | 22-28 Nm |
| Bolt - Door Lock Striker | 15-21 Nm |
| Flange Bolt- Door Check | 22-28 Nm |
| Flange Bolt - Door Hinge Body Side | 30-36 Nm |
| Bolt - Front Door Handle Liner Assembly End | 2-2.5 Nm |
| Bolt - Front Door Lock Body | 8-12 Nm |
| Bolt - Rear Door Lock Body | 8-12 Nm |
| Bolt - Window Outer Weatherstrip Retainer | 3-5 Nm |
| Screw - Door Glass | 2-4 Nm |
| Nut - Glass Regulator | 7-10 Nm |
| Nut - Front Door Glass Rail Extension | 6-10 Nm |
| Nut - Rear Door Partition Rail | 1.0-1.5 Nm |
| Nut - Rear Door Partition Rail | 6-8 Nm |

Description and Operation

System Component Layout

Window System Component Layout



1. Driver Side Window Switch

2. Driver Side Glass Regulator Motor

3. Front Passenger Side Window Switch

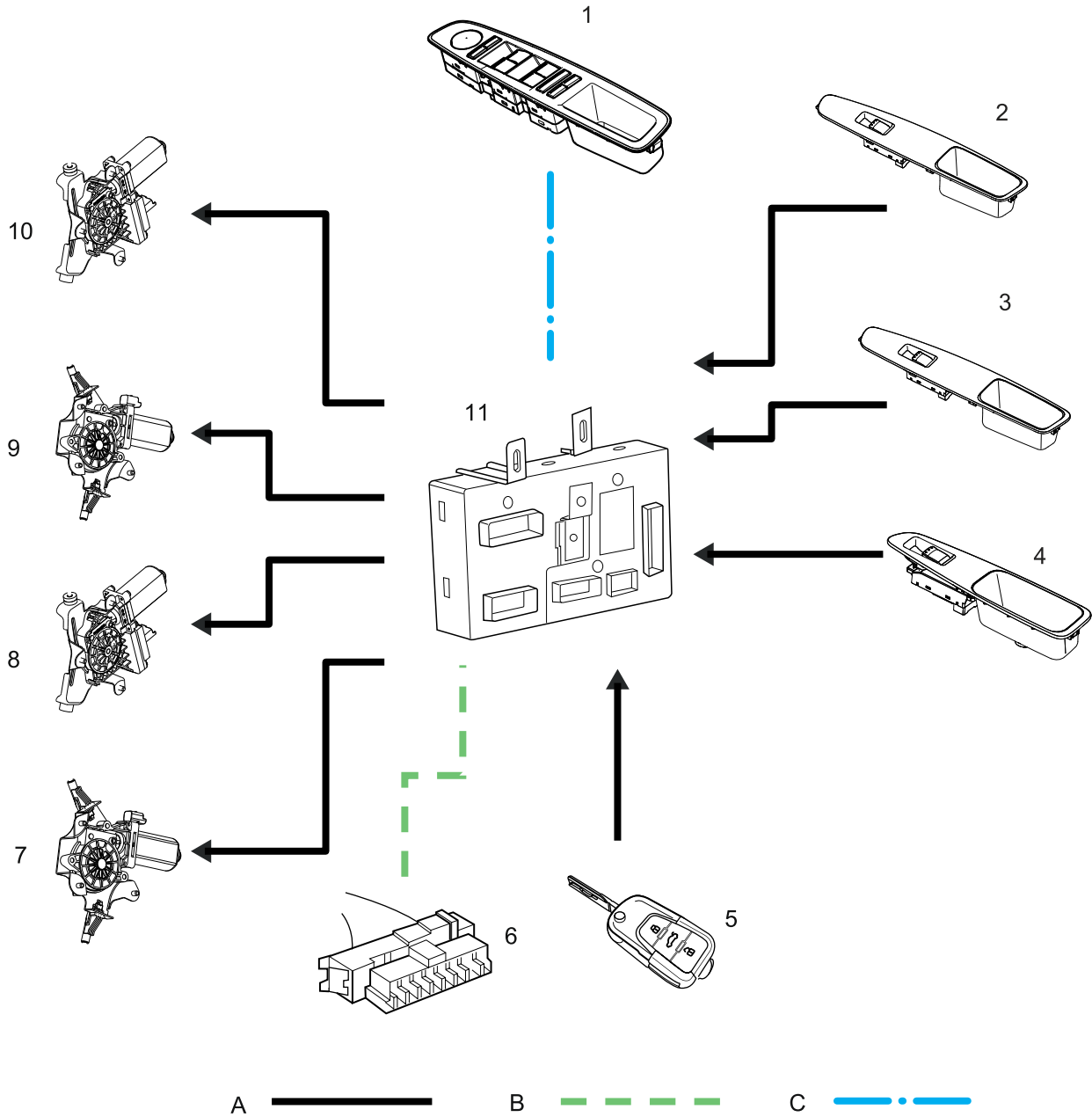
4. Front Passenger Side Glass Regulator Motor

5. Rear Passenger Side Glass Regulator Motor

6. Rear Passenger Side Window Switch

System Control Diagram

Window System Control Diagram



- | | |
|--|---|
| <ul style="list-style-type: none"> 1. Driver Side Window Switch 2. Front Passenger Side Window Switch 3. Rear Passenger Side Window Switch RH 4. Rear Passenger Side Window Switch LH 5. Wireless Key 6. Diagnostic Socket | <ul style="list-style-type: none"> 7. Driver Side Glass Regulator Motor 8. Rear Passenger Side Glass Regulator Motor LH 9. Rear Passenger Side Glass Regulator Motor RH 10. Front Passenger Side Glass Regulator Motor 11. Body Control Module |
|--|---|

Description

General Description

All models are equipped with the front and rear power window system. This system is controlled by the body control module (**BCM**) behind the front passenger side glove box.

The power window system contains:

- Front and rear power window LH and RH.
- Driver door switch kit (**DDSP**).
- Single switches on the front and rear passenger doors.
- Window regulator motor and regulator mechanism.

Lift/press type switches are fitted on each door inner garnish and are used to control power windows on each door. **DDSP** has 4 power window switches to control the operation of all windows by the driver. Power windows can be operated after the ignition key is in **AUX** range or within 30 seconds after the wireless key is removed. Just after starting, the windows have no motion by operating the window switches.

The power window system with the anti-trap and one-touch function is equipped on the driver side doors of all models as a standard configuration.

Operation

Power Window

When the key is inserted into the keyhole, and turned to "AUX" gear position or within 30 seconds after the ignition switch is turned off, the power window system is in operation. Four window motors are connected to the power source positive respectively through four fuses in the engine bay fuse box. **BCM** responds to the signals from each switch, and supplies power to each appropriate window motor, to raise or lower the windows.

Manual Mode

The manual mode starts when the driver side window switch is operated for more 400 ms in certain direction, i.e. the selected window continues running in the required direction, and the window stops moving in this direction immediately until the switch is released. For the window switches of the front passenger side and the rear passenger, the people can perform the manual mode in addition to operating the driver switch for above 400ms, they can also perform the individual manual switch operation to the window controlled by operating the appropriate window up or down switch separately for more than 400ms.

Automatic (One-touch) Mode

On all of the power windows with smart (Anti-trap) window raising motor fitted (This function is equipped on the driver side power window of all models), their auto modes have the "one-touch" up (With anti-trap function) and down function. When the window switch operation time is more than 60 ms but less than 400 ms, the one-touch up and down mode will be started to perform. After the switch is released, it will lower the window until it is fully opened (Or to go up until it is fully closed and with the anti-trap function). In the auto mode, select the up or down switch of the driver side window control switch again and the auto mode will be exited.

Anti-trap Function

Smart window raising motor has an anti-trap function. Before the expected highest or lowest point is detected, any increment shown on the current will be assumed that some obstacles exist. If such condition occurs when the window is raised, the motor polarity will reverse automatically, thus the window is fully opened. When the window jam condition happens with the window open, press the driver side window switch again, the window will be stopped lowering and the anti-trap detection will be reset.

The Operation of Opening and Closing All of the Windows

After the ignition switch is turned off, press (For more than 2 seconds) the driver side door lock switch to the lock position under the condition that there are one or more windows or the sunroof is open, all of the opened windows or sunroof will be closed. Also, after the ignition switch is turned off, press (For more than 2 seconds) the driver side door lock switch to the unlock position under the condition that there are one or more windows or the sunroof is closed, all of the closed windows or sunroof will be opened.

When all of the windows is operating, stop using the lock/unlock switch, and the operation of opening and closing all of the windows will stop immediately.

Thermal Protection

DO NOT drive the window motor for more than 15 seconds to avoid damaging the power window motor.

Rear Window Disable

DDSP has a rear window isolated switch which can activate/prohibit the rear window switch function controlling the window lift. After the rear window disable switch is activated, **LED** indicator on the driver side rear window disable switch turns on, and the rear passenger cannot control the rear window through the rear passenger power window switch. **BCM** stores the select status of the isolated switch controlled by the driver, until the driver gets a new choose for this switch status again.

Open in a Collision

If the vehicle involves in collision and the collision acceleration reaches a certain value, the inertia switch will be activated. This switch will allow all the windows to open automatically.

Switch Conflict

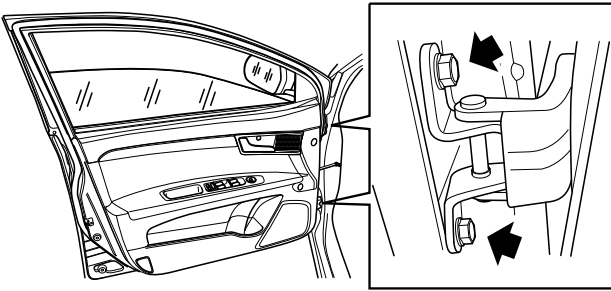
If there is a signal command conflict between the window switch in the **DDSP** and the special switch the door of this window, **DDSP** has a priority. If any window stops due to a command conflict between the **DDSP** and the special switch on the door of this window, the window only moves to the required direction in a step mode if this window continues to be operated again after any switch is released. If any switch is activated for more than 20 seconds, the **BCM** will determine this switch as a trouble switch (Such as stuck), and ignore all the further commands from the switches in this start circulation after that.

Service Procedures

Adjustment of Front Door Hinge

Adjustment

1. Open the front door.
2. Place the wooden blocks on the jack, and position the jack under the vehicle to support the front door.
3. Unscrew the 4 bolts securing upper and lower hinges to the door side.



4. Use a jack to support the vehicle and correct the door.
5. Pretighten the hinge bolts.
6. Take away the jack, and close the door to check if the correction is proper.
7. When the correction reaches to the required effect, tighten the hinge bolts to the rated torque **22-28 Nm**, and check the torque.

Adjustment of Front Door Striker

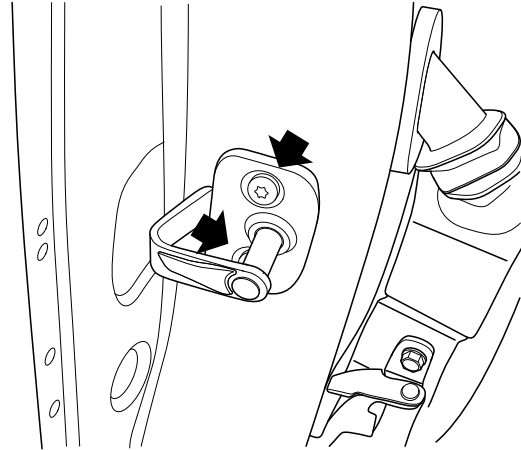
Adjustment

Front door striker is a latch with two screws. In most cases, it is necessary to adjust the striker up and down or inside and outside:

- Frame damage resulting from a collision
- Fit a new door weatherstrip
- The customer reports that the wind noise is too loud
- It is difficult to open and close the door

Adjust the door striker up and down or inside and outside using the following procedures:

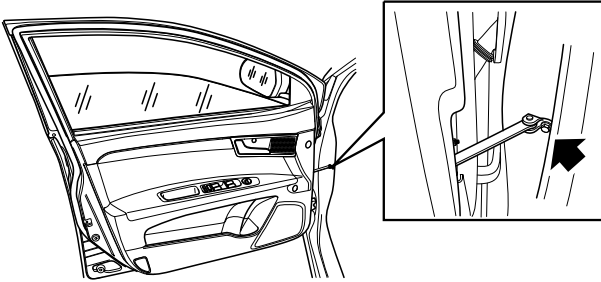
1. The door must be positioned correctly.
2. Open the front door.
3. Loosen the 2 striker screws. Adjust the striker to align the door pin, and then pretighten the screws.



4. Close the door, and check if the rear of the door is flush with the panel of the body side panel and if the door can open and close normally.
5. After the correction, open the door, and tighten the screws to **15-21 Nm**, and check the torque.
6. Close the door.

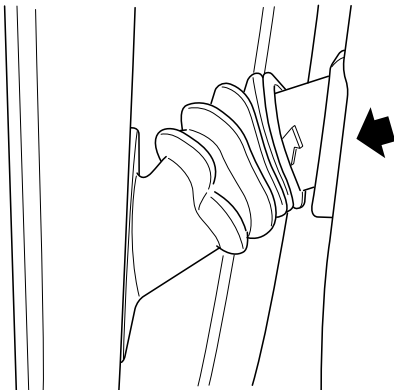
Front Door Assembly**Removal**

1. Disconnect the battery negative terminal.
2. Remove the mounting bolt securing the door check to the body side.

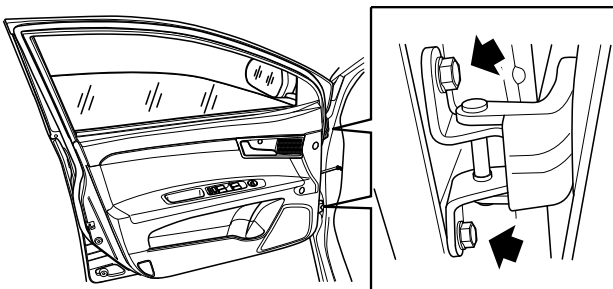


2. Connect the connector interface, and insert the rubber seal ring into the mounting hole of the body.
3. Fit the set bolts between the upper and lower hinges of the front door and the door side, and tighten the torque to **22-28 Nm**, and check the torque.
4. Fit the set bolts between the door check and the body side, and tighten the torque to **22-28 Nm**, and check the torque.
5. Close the door and check the door opening and closing effect.
6. Connect the battery negative terminal.

3. Pry up the rubber seal ring of the body side, and pull the connector out to disconnect the the connector interface.



4. With the help of an assistant, hold the outside of the door, and unscrew the 4 mounting bolts securing the upper and lower hinges to the door side.



5. Remove the front door assembly.

Refit

1. Position the door to the body with the help of an assistant.

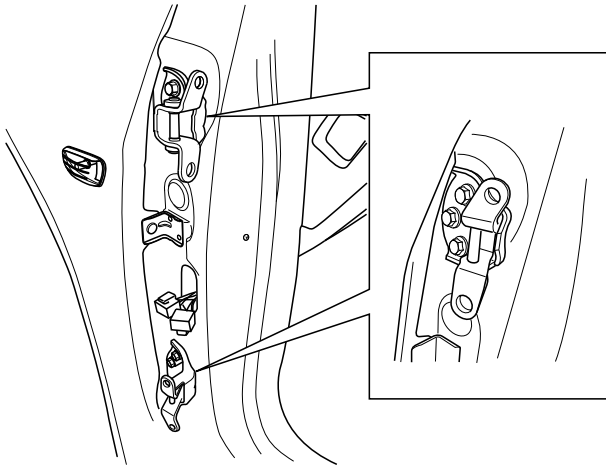
Front Door Hinge Assembly

Removal

1. Remove the front door assembly with the help of an assistant.

Front Door Assembly

2. Unscrew the 6 mounting bolts between the upper and lower hinges and the body side respectively, and remove the upper and lower hinges.



Refit

1. Secure the upper and lower hinges to the body with 6 bolts respectively and tighten the torque to **30-36 Nm**, and check the torque.
2. Fit the front door assembly with the help of an assistant.

Front Door Assembly

Driver Side Door Outside Handle

Removal

1. Ensure that the windows rise to the highest position.
2. Remove the driver side door inner garnish assembly.

Front Door Inner Garnish Assembly

3. Remove the driver side door waterproof film.

Front Door Waterproof Film

4. Remove the driver side door lock cylinder.

Driver Side Door Lock Cylinder

5. Lightly pull the outside handle towards the rear of vehicle, and pull out the front end of the outside handle, then pull out its rear end to remove the outside handle.

Refit

1. Ensure that the front and rear shims of the door outside handle are fitted.
2. Insert the front end of the door outside handle into the front mounting holes first, and then fit the rear end of the handle, and move it towards the front of the body.
3. Fit the door lock cylinder.

Driver Side Door Lock Cylinder

4. Pull the door outside handle, and check if the door lock connecting rod is securely connected.
5. Fit the door waterproof film.

Front Door Waterproof Film

6. Fit the driver side door inner garnish assembly.

Front Door Inner Garnish Assembly

Driver Side Door Lock Cylinder Assembly**Removal**

1. Ensure that the windows rise to the highest position.
2. Remove the driver side door inner garnish assembly.

 **Front Door Inner Garnish Assembly**

3. Remove the driver side door waterproof film.

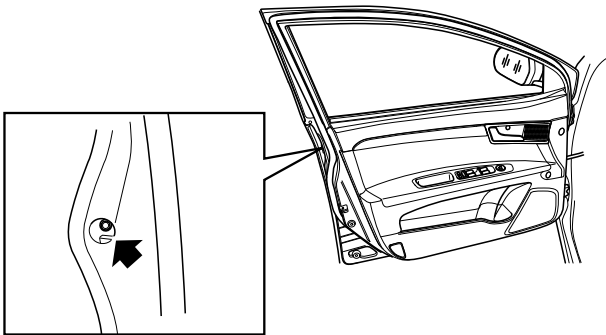
 **Front Door Waterproof Film**

4. Pry up the black rubber plug of the door end, and unscrew the inner hexagon socket bolt.

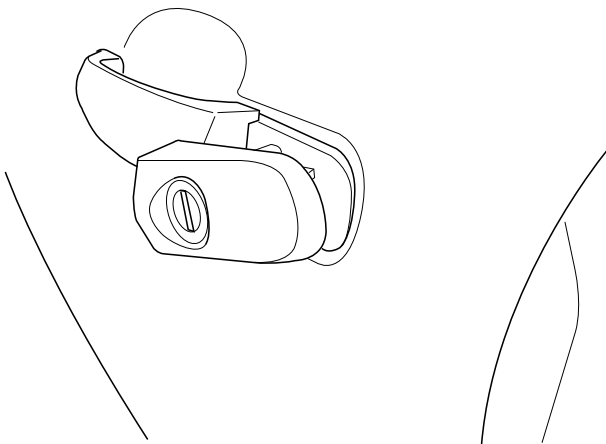
4. Fit the door waterproof film.

 **Front Door Waterproof Film**

5. Fit the driver side door inner garnish assembly.

 **Front Door Inner Garnish Assembly**

5. Carefully pry up the connecting rod snap fits connected to the door lock cylinder with the flat-head screwdriver, to release the connecting rod connected to the door lock cylinder.
6. Remove the lock cylinder assembly from the outside of the door.

**Refit**

1. Insert the door cylinder assembly into the mounting holes, and secure it from the door end with the bolt with the rated torque is **2-2.5 Nm**, and check the torque.
2. Use the flat-head screwdriver, carefully secure the lock cylinder connecting rod with the snap fit.
3. Pull the door outside handle, and check if the door lock connecting rod is securely connected.

Driver Side Door Lock Body Assembly

Removal

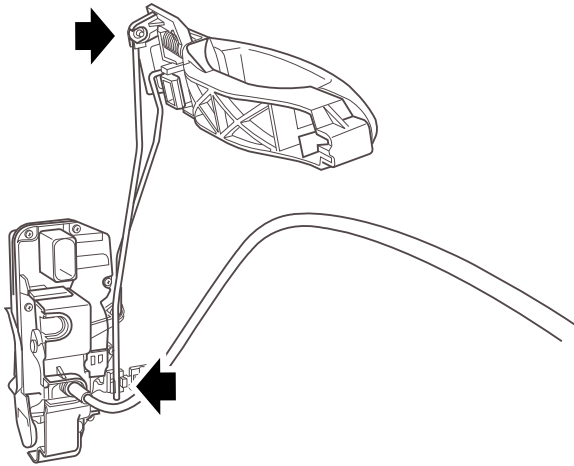
1. Disconnect the battery negative terminal.
2. Remove the driver side door inner garnish assembly.

Front Door Inner Garnish Assembly

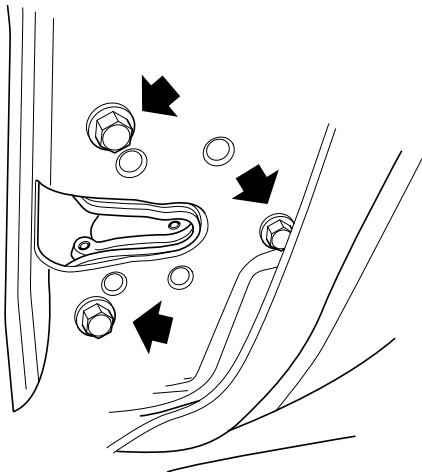
3. Remove the waterproof film.

Front Door Waterproof Film

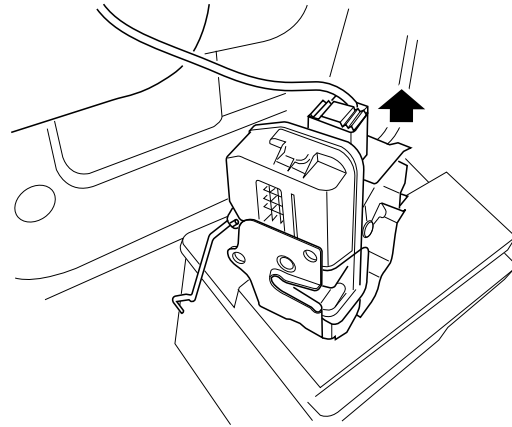
4. Carefully pry up the 2 connecting rod snap fits connected to the door outside handle and door lock cylinder with the flat-head screwdriver, to release the connecting rod.



5. Unscrew the 3 bolts securing the door lock.



6. Carefully remove the snap fits securing the cable from the door inner panel.
7. Carefully take the door lock out of the door inner chamber, and disconnect the wire harness interface from the top portion of the lock body assembly back and the door system.
8. Carefully separate the cable end from the lock body assembly, to completely remove the door lock body assembly as shown in the illustration.



Refit

1. Connect the door lock to the wire harness interface firmly.
2. Carefully fit the cable end to the lock body assembly.
3. Carefully fit the connected lock body assembly to door inner chamber from the inside of the door and align the mounting holes on the door.
4. Fit 3 bolts securing the door lock, but DO NOT tighten them first.
5. Use a flat-head screwdriver, carefully secure the 2 connecting rods connected to the door outside handle and door lock cylinder with the snap fit.
6. Respectively tighten the 3 lock body mounting bolts in the order of up, down, middle to **8-12 Nm**, and check the torque.
7. Pull the door outside handle, and check if the door lock connecting rod is securely connected.
8. Apply the door waterproof film.

Front Door Waterproof Film

9. Fit the door inner garnish.

Front Door Inner Garnish Assembly

10. Connect the battery negative terminal.

Front Passenger Side Door Outside Handle**Removal**

1. Ensure that the windows rise to the highest position.
2. Remove the passenger side door inner garnish assembly.

 **Front Door Inner Garnish Assembly**

3. Remove the passenger side door waterproof film.

 **Front Door Waterproof Film**

4. Remove the passenger side door outside handle cover.

 **Passenger Side Door Outside Handle Cover**

5. Lightly pull the outside handle towards the rear of vehicle, and pull out the front end of the outside handle, then pull out its rear end to remove the outside handle.

Refit

1. Ensure that the front and rear shims of the door outside handle are fitted.
2. Insert the front end of the door outside handle into the front mounting holes first, and then fit the rear end of the handle, and move it towards the front of the body.
3. Fit the door outside handle cover.

 **Passenger Side Door Outside Handle Cover**

4. Pull the door outside handle, and check if the door lock connecting rod is securely connected.
5. Fit the door waterproof film.

 **Front Door Waterproof Film**

6. Fit the passenger side door inner garnish assembly.

 **Front Door Inner Garnish Assembly****Front Passenger Side Door Lock Cylinder Cover Assembly****Removal**

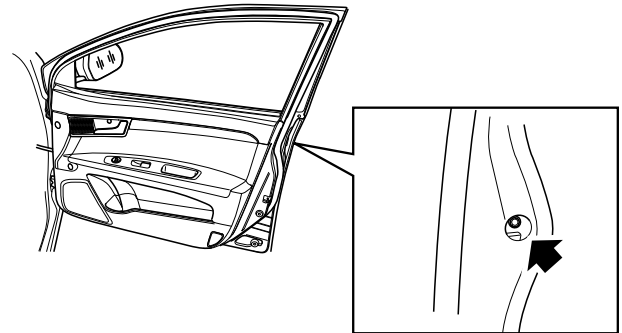
1. Ensure that the windows rise to the highest position.
2. Remove the passenger side door inner garnish assembly.

 **Front Door Inner Garnish Assembly**

3. Remove the passenger side door waterproof film.

 **Front Door Waterproof Film**

4. Pry up the black rubber plug of the door end, and unscrew the inner hexagon socket bolt.



5. Remove the cover assembly from the outside of the door.

Refit

1. Insert the door cover assembly into the mounting holes, and secure it from the door end with the bolt with the rated torque is **2-2.5 Nm**, and check the torque.
2. Fit the door waterproof film.

 **Front Door Waterproof Film**

3. Fit the passenger side door inner garnish assembly.

 **Front Door Inner Garnish Assembly**

Front Passenger Side Door Lock Body Assembly

Removal

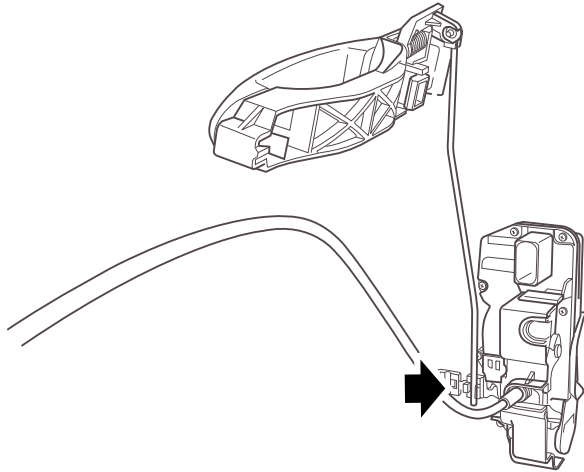
1. Disconnect the battery negative terminal.
2. Remove the passenger side door inner garnish assembly.

 **Front Door Inner Garnish Assembly**

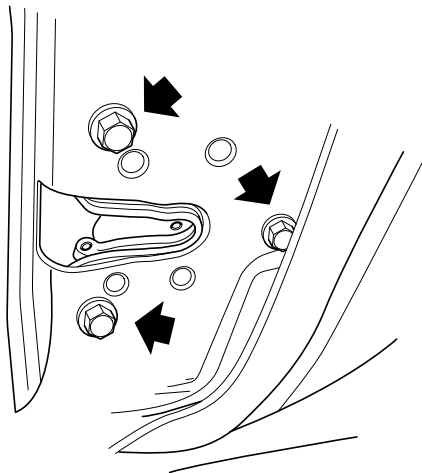
3. Remove the waterproof film.

 **Front Door Waterproof Film**

4. Carefully pry up the I connecting rod snap fit connected to the door outside handle with the flat-head screwdriver to release the connecting rod.



5. Unscrew the 3 bolts securing the door lock, and remove the door lock assembly from the door inner chamber carefully.



6. Carefully separate the cable end from the lock body assembly, to completely remove the door lock assembly.

Refit

1. Carefully fit the cable end to the lock body assembly.
2. Carefully fit the door lock to the door inner chamber from the inside of the door and position it.
3. Fit 3 bolts securing the door lock, and the rated torque is **8-12 Nm**, and check the torque.
4. Use a flat-head screwdriver, carefully secure I connecting rod connected to the door outside handle with the snap fit.

5. Pull the door outside handle, and check if the door lock connecting rod is securely connected.

6. Fit the door waterproof film.

 **Front Door Waterproof Film**

7. Fit the door inner garnish assembly.

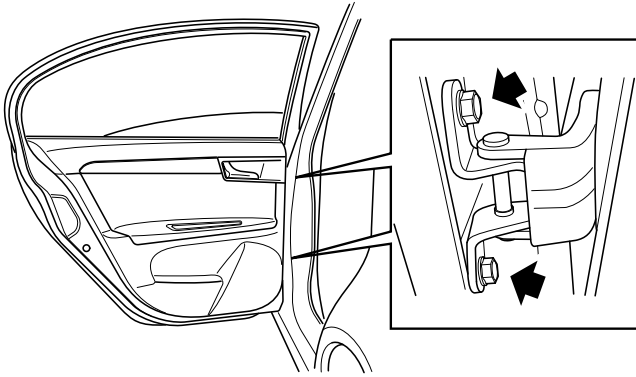
 **Front Door Inner Garnish Assembly**

8. Connect the battery negative terminal.

Adjustment of Rear Door Hinge

Adjustment

1. Open the rear door.
2. Place a wooden block on the jack, and position the jack under the vehicle to support the rear door.
3. Unscrew the 4 bolts securing upper and lower hinges to the rear door side.



4. Use a jack to correct the door.
5. Pretighten the hinge bolts.
6. Take away the jack, and close the door to check if the correction is proper.
7. When the correction reaches to the required effect, tighten the hinge bolts to the rated torque **22-28 Nm**, and check the torque.

Adjustment of Rear Door Striker

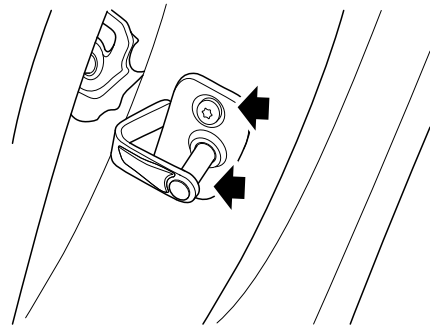
Adjustment

Rear door striker is a latch with two screws. In most cases, it is necessary to adjust the striker up and down or inside and outside:

- Frame damage resulting from a collision
- Fit a new door weatherstrip
- The customer reports that the wind noise is too loud
- It is difficult to open and close the door

Adjust the door striker up and down or inside and outside using the following procedures:

1. The door must be positioned correctly.
2. Open the rear door.
3. Loosen the 2 screws of the striker. Adjust the striker to align the door pin, and then pretighten the screws.

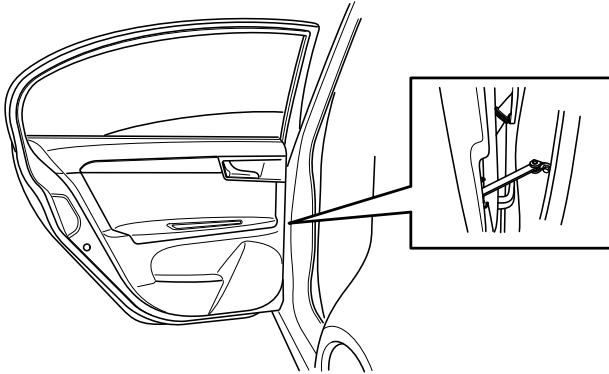


4. Close the door, and check if the rear of the door is flush with the panel of the body side panel and if the door can open and close normally.
5. After the correction, open the door, and tighten the screws to **15-21 Nm**, and check the torque.
6. Close the door.

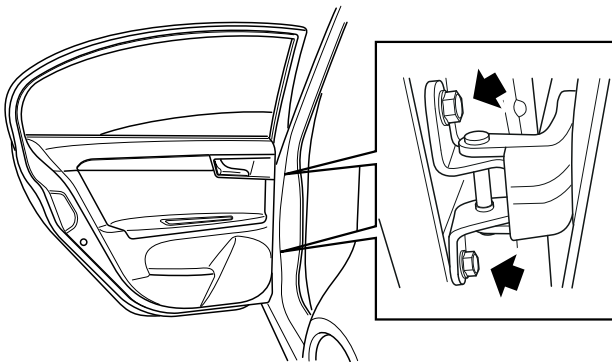
Rear Door Assembly

Removal

1. Disconnect the battery negative terminal.
2. Unscrew the mounting bolt securing the door check to the body side.



3. Pry up the rubber seal ring of the body side, and pull the connector out to disconnect the connector interface.
4. With the help of an assistant, hold the outside of the door, and unscrew the 4 mounting bolts securing the upper and lower hinges to the door side.



5. Remove the rear door assembly.

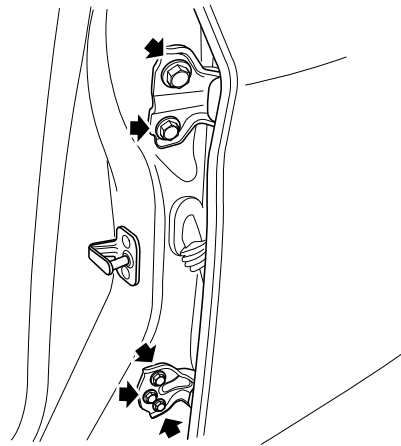
Refit

1. Position the door to the body with the help of an assistant.
2. Connect the connector interface, and insert the rubber seal ring into the mounting hole of the body.
3. Fit the set bolts between the upper and lower hinges of the rear door and the door side, and tighten the torque to **22-28 Nm**, and check the torque.
4. Fit the set bolts between the door check and the body side, and tighten the torque to **22-28 Nm**, and check the torque.
5. Close the door and check the door opening and closing effect.
6. Connect the battery negative terminal.

Rear Door Hinge Assembly

Removal

1. Disconnect the battery earth lead.
2. Open the front door.
3. Pry up the rubber seal ring of the body side, and pull the connector out to disconnect the the connector interface.
4. Unscrew the mounting bolt securing the door check to the body side.
5. With the help of an assistant, hold the outside of the rear door, and unscrew the 5 mounting bolts securing the upper and lower hinges to the door side respectively, and remove the rear door.



6. Remove the mounting bolts between the upper and lower hinges and the door side from the removed rear door so that the hinge assembly is removed.

Refit

1. Secure the upper and lower hinges to the body with 5 bolts, and then tighten the torque to **30-36 Nm**, and check the torque.
2. Position the door to the body with the help of an assistant, connect the connector interface, and insert the rubber seal ring into the mounting holes of the body.
3. Fit the set bolts between the upper and lower hinges of the rear door and the door side, and tighten the torque to **22-28 Nm**, and check the torque.
4. Fit the set bolts between the door check and the body side, and tighten the torque to **22-28 Nm**, and check the torque.
5. Connect the battery earth lead.
6. Close the door and check the door opening and closing effect.

Rear Door Outside Handle**Removal**

1. Ensure that the windows rise to the highest position.
2. Remove the rear door inner garnish assembly.

 **Rear Door Inner Garnish Assembly**

3. Remove the rear door waterproof film.

 **Rear Door Waterproof Film**

4. Remove the rear door lock cylinder cover assembly.

 **Rear Door Lock Cylinder Cover Assembly**

5. Lightly pull the outside handle towards the front of vehicle, and pull out the rear end of the outside handle, then pull out its front end to remove the outside handle.

Refit

1. Ensure that the front and rear shims of the door outside handle are fitted.
2. Insert the front end of the door outside handle into the mounting holes first, and then fit the rear end of the handle, and move it to the front of the body.
3. Fit the rear door lock cylinder cover assembly.

 **Rear Door Lock Cylinder Cover Assembly**

4. Pull the door outside handle, and check if the door lock connecting rod is securely connected.
5. Fit the door waterproof film.

 **Rear Door Waterproof Film**

6. Fit the rear door inner garnish assembly.

 **Rear Door Inner Garnish Assembly****Rear Door Lock Cylinder Cover Assembly****Removal**

1. Ensure that the windows rise to the highest position.
2. Remove the rear door inner garnish assembly.

 **Rear Door Inner Garnish Assembly**

3. Remove the rear door waterproof film.

 **Rear Door Waterproof Film**

4. Pry up the black rubber plug of the door end, and unscrew the inner hexagon socket bolt.
5. Remove the cover assembly from the outside of the door.

Refit

1. Insert the door cover assembly into the mounting holes, and tighten bolts from the door end to secure it.
2. Fit the door waterproof film.

 **Rear Door Waterproof Film**

3. Fit the rear door inner garnish assembly.

 **Rear Door Inner Garnish Assembly**

Rear Door Lock Body Assembly

Removal

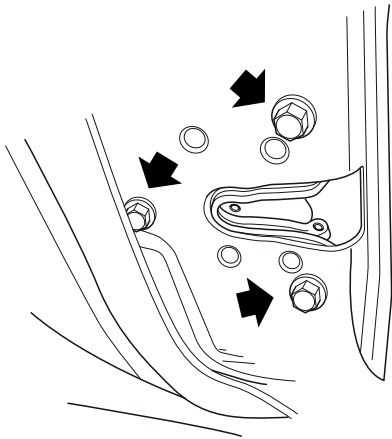
1. Disconnect the battery negative terminal.
2. Remove the rear door inner garnish assembly.

Rear Door Inner Garnish Assembly

3. Remove the waterproof film.

Rear Door Waterproof Film

4. Carefully pry up a connecting rod snap fit connected to the door outside handle with the flat-head screwdriver to release the connecting rod.
5. Unscrew the 3 bolts securing the door lock, and remove the door lock from the door inner chamber carefully.



6. Carefully separate the cable end from the lock body assembly, to completely remove the door lock assembly.

Refit

1. Carefully fit the cable end to the lock body assembly.
2. Carefully fit the door lock to the door inner chamber from the inside of the door and align the mounting holes on the door.
3. For the rear door LH, it is also necessary to check if the child safety switch is aligned with the panel hole.
4. Fit 3 bolts securing the door lock, but **DO NOT** tighten them first.
5. Use a flat-head screwdriver, carefully secure 1 connecting rod connected to the door outside handle with the snap fit.
6. Respectively tighten the 3 lock body mounting bolts in the order of up, down, middle to **8-12 Nm**, and check the torque.
7. Pull the door outside handle, and check if the door lock connecting rod is securely connected.
8. Apply the door waterproof film.

Rear Door Waterproof Film

9. Fit the door inner garnish.

Rear Door Inner Garnish Assembly

10. Connect the battery negative terminal.

Front Door Weatherstrip**Removal**

1. Disconnect the battery negative terminal.
2. Remove the outer rear view mirror.

 **Outer Rear View Mirror**

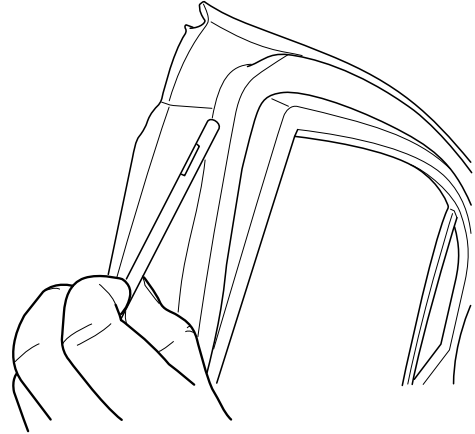
3. Remove the front door weatherstrip.

Refit

1. Insert the two holes on the upper corner of the front door weatherstrip into the weld bolt and punched hole on the upper frame of the door. Remove the protective paper from the double-sided tape on the weatherstrip, and then apply it to the door panel. Fit the weatherstrip above the belt line into the rail of the door upper frame in sequence. Fit the remaining weatherstrip to the corresponding hole of the door inner panel with the snap fit.
2. Fit the outer rear view mirror.

 **Outer Rear View Mirror****Rear Door Weatherstrip****Removal**

1. Remove the rear door weatherstrip cover.
2. Remove the rear door weatherstrip.



S91001

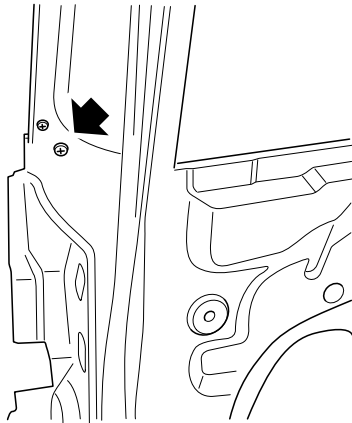
Refit

1. Insert the holes on the upper corner of the rear door weatherstrip into the weld bolt on the upper frame of the door. Fit the rear door weatherstrip above the belt line into the rail of the door upper frame. Fit the remaining parts to the corresponding hole of the door inner panel with the snap fit.
2. Fit the rear door weatherstrip cover.

Door Window Outer Weatherstrip

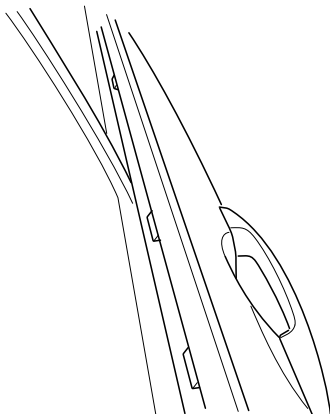
Removal

1. Unscrew 1 window outer weatherstrip set screw.



S91002

2. Carefully loosen the snap fits securing the window outer weatherstrip to the door from the front of the door to the end of the door in sequence and remove them.



S91003

Refit

1. Position the door window outer weatherstrip to the door and secure it with the snap fit.
2. Fit the window outer weatherstrip set screws, and tighten them to **3-5 Nm**.
3. If the rear door window outer weatherstrip needs to be fitted, align the last snap fit on the tail end with the square hole in the body panel and insert it forcefully to tighten the weatherstrip and the body.

Door Glass

Removal

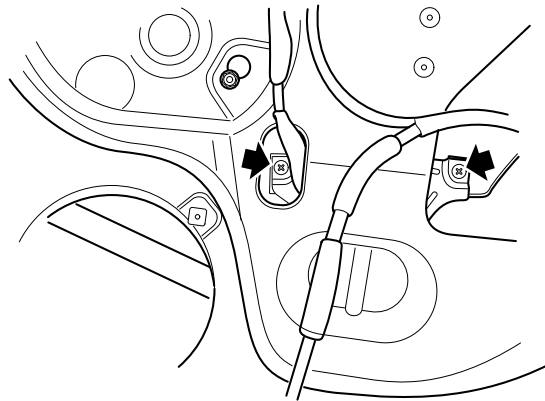
1. Disconnect the battery negative terminal.
2. Remove the front door weatherstrip.

Front Door Weatherstrip

3. Remove the front door inner garnish.

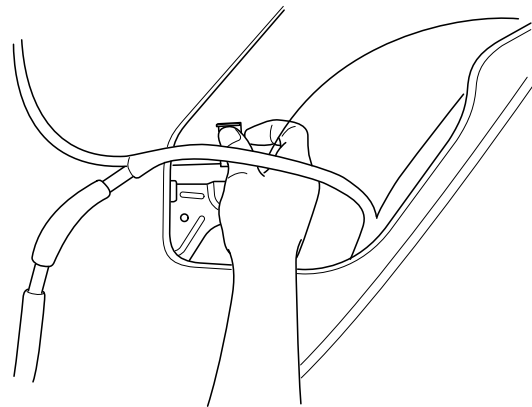
Front Door Inner Garnish

4. Remove the waterproof film.
5. Unscrew the 2 set screws securing glass to the window regulator.



S91004

6. Carefully take the door glass out of the door inner chamber.



S91005

Refit

1. Fit the glass to the glass regulator of the door inner chamber to the glass window regulator. Hang the glass on the slider by the small step of the gaiter, and align the gaiter hole on the glass with the glass regulator slider hole.
2. Fit the glass to the window regulator with 2 screws, and tighten to **2-4 Nm**.
3. Fit the waterproof film.
4. Fit the front door inner garnish.

Front Door Inner Garnish

5. Fit the front door weatherstrip.

Front Door Weatherstrip

6. Connect the battery negative terminal.

Front Door Glass Regulator

Removal

1. Disconnect the battery negative terminal.
2. Remove the outer rear view mirror.

Outer Rear View Mirror

3. Remove the door window outer weatherstrip.

Door Window Outer Weatherstrip

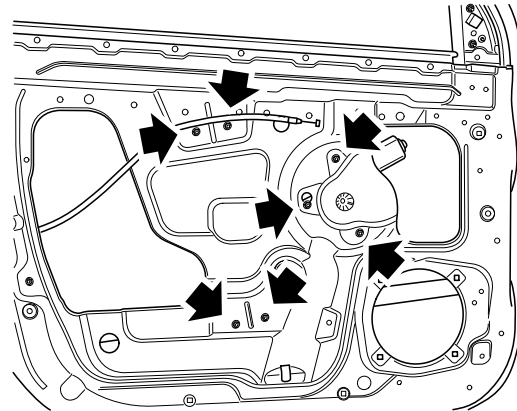
4. Remove the front door inner garnish.

Front Door Inner Garnish

5. Remove the waterproof film.
6. Remove the door glass.

Door Glass

7. Unscrew the 7 nuts securing the front door glass regulator to the door, and remove the glass regulator.



S91006

Refit

1. Secure the glass regulator to the door, and fit 7 front glass regulator set nuts from top to bottom and from left to right, and then tighten them to **7-10 Nm**.
2. Fit the door glass.

Door Glass

3. Fit the waterproof film.
4. Fit the front door inner garnish.

Front Door Inner Garnish

5. Fit the door window outer weatherstrip.

Door Window Outer Weatherstrip

6. Fit the outer rear view mirror.

Outer Rear View Mirror

7. Connect the battery negative terminal.

Rear Door Glass Regulator

Removal

1. Disconnect the battery negative terminal.
2. Remove the door window outer weatherstrip.

Door Window Outer Weatherstrip

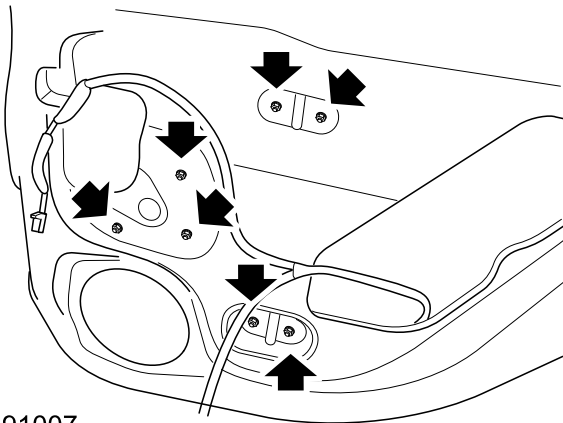
3. Remove the rear door inner garnish.

Rear Door Inner Garnish

4. Remove the waterproof film.
5. Remove the door glass.

Door Glass

6. Unscrew the 7 nuts securing the rear door glass regulator to the door, and remove the glass regulator.



S91007

Refit

1. Secure the glass regulator to the door, and fit 7 front glass regulator set nuts from top to bottom and from left to right, and then tighten them to **7-10 Nm**.
2. Fit the door glass.

Door Glass

3. Fit the waterproof film.
4. Fit the rear door inner garnish.

Rear Door Inner Garnish

5. Fit the door window outer weatherstrip.

Door Window Outer Weatherstrip

6. Connect the battery negative terminal.

Front Door B Pillar Glass Rail Extension

Removal

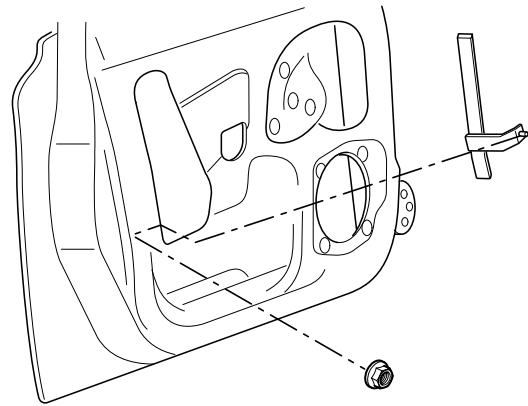
1. Disconnect the battery negative terminal.
2. Remove the front door inner garnish.

Front Door Inner Garnish

3. Remove the waterproof film.
4. Remove the door glass.

Door Glass

5. Remove the nut fitting the lower end of the front glass rail extension to the door.



S91008

6. Remove the front door B pillar glass rail extension.

Refit

1. Place the front door glass rail extension at the predetermined position, insert the upper end of the rail to the door connecting bracket.
2. Fit the lower end of the front door glass rail extension to the door inner panel mounting holes with the nuts, tighten the torque to **6-10 Nm**.
3. Fit the door glass.

Door Glass

4. Fit the waterproof film.
5. Fit the front door inner garnish.

Front Door Inner Garnish

6. Connect the battery negative terminal.

Rear Door Partition Rail**Removal**

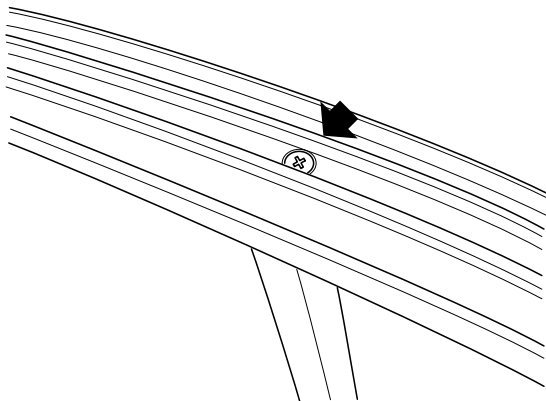
1. Disconnect the battery negative terminal.
2. Remove the rear door inner garnish.

 **Rear Door Inner Garnish**

3. Remove the waterproof film.
4. Remove the door glass.

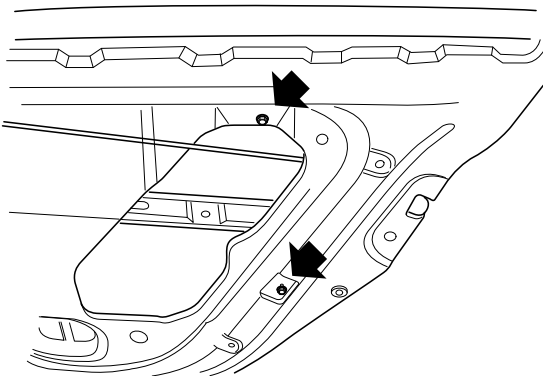
 **Door Glass**

5. Remove the 1 rear door partition rail set screw.



S91009

6. Remove the 2 rear door partition rail set screws.



S91010

7. Remove the rear door partition rail.

Refit

1. Align the upper hole in the rail, and fit the upper rail set screw, and tighten the torque to **1.0-1.5 Nm**.
2. Align the centre and lower bracket holes of the glass rail with the door inner panel, and fit 2 set screws, and tighten the torque to **6-8 Nm**.
3. Fit the door glass.

 **Door Glass**

4. Fit the waterproof film.
5. Fit the rear door inner garnish.

 **Rear Door Inner Garnish**

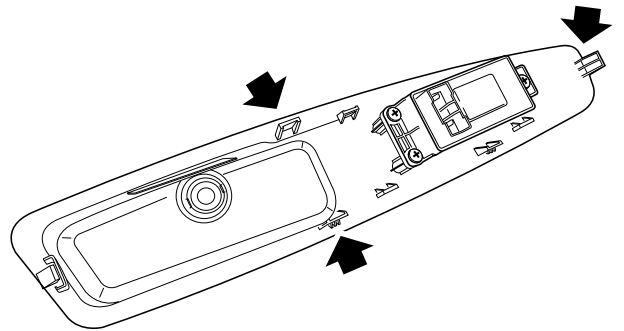
6. Connect the battery negative terminal.

Power Window Switch - Driver Side**Removal**

1. Disconnect the battery negative terminal.
2. Remove the front door inner garnish.

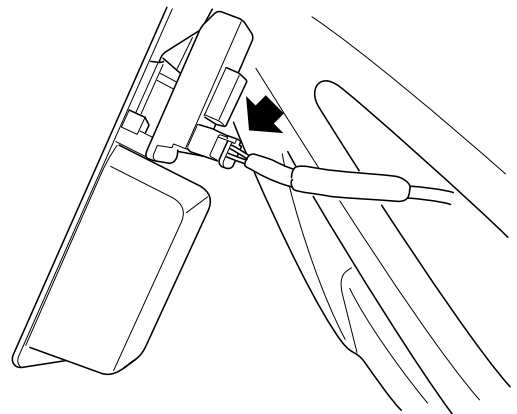
 **Front Door Inner Garnish**

3. Carefully release the snap fits securing the window combination switch to the door inner garnish.



S91011

4. Disconnect the electrical connector.



S91012

5. Remove the power window switch.

Refit

1. Connect the electrical connector.
2. Insert the snap fits securing the window combination switch to the door inner garnish to the inner garnish.
3. Fit the front door inner garnish.

 **Front Door Inner Garnish**

4. Connect the battery negative terminal.

Power Window Switch - Others

Removal

1. Disconnect the battery negative terminal.
2. Remove the rear door inner garnish.

Rear Door Inner Garnish

3. Carefully release the snap fits securing the window combination switch to the door inner garnish.
4. Disconnect the electrical connector.
5. Remove the power window switch.

Refit

1. Connect the electrical connector.
2. Insert the snap fits securing the window combination switch to the door inner garnish to the inner garnish.
3. Fit the rear door inner garnish.

Rear Door Inner Garnish

4. Connect the battery negative terminal.

Front Closures**Specifications****Torque**

| Description | Value |
|---|------------|
| Bolt - Modular Front End Panel Assembly | 20.9 Nm |
| Bolt - Bonnet Lock Body Assembly | 7-10 Nm |
| Nut - Bonnet Hinge and Bonnet | 19-25 Nm |
| Bolt - Bonnet Hinge and Body | 26-34 Nm |
| Screw - Bonnet Opener Handle | 1.3-1.9 Nm |
| Nut - Bonnet Garnish | 2.0-3.0 Nm |
| Screw - Bonnet Garnish | 1.5-2.0 Nm |

Service Procedures

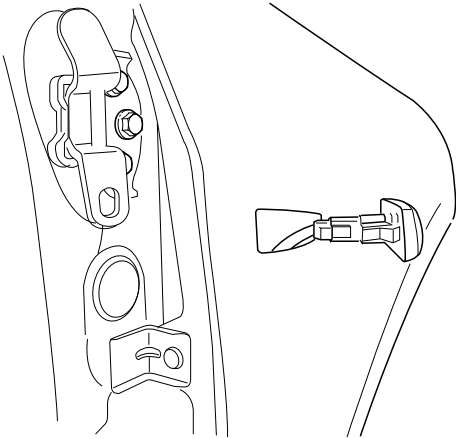
Replacement of Fender

Removal

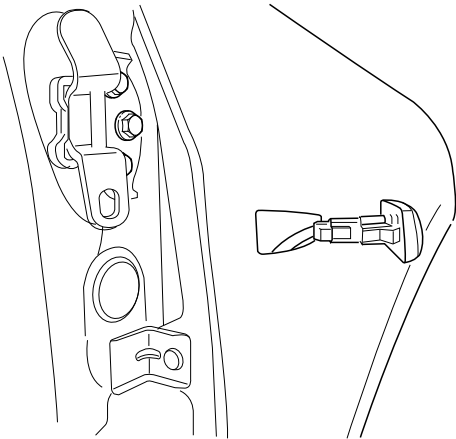
1. Remove the front wheel splash shield.
2. Remove the front bumper.

Front Bumper

3. Press out the side direction indicator snap fit from the inside of body frame.



4. Disconnect the electrical connectors and remove the side direction indicator.



5. Remove the quarter window pad assembly.
6. Remove the fender noise-absorbing lining.
7. Remove the 8 bolts and 1 nut securing the fender to the body.
8. Remove the fender.

Caution: The panel area where the fender rubber cushion drops should be worked with anti-rust after removing the fender.

Refit

1. Position and adjust the fender.
2. Secure the fender to the body, DO NOT tighten the bolt.
3. Adjust the intervals between the fender and each adjacent fender, and make the intervals be even. Then

tighten the 8 bolts and 1 nut securing the fender to the body.

4. Connect the electrical connectors.
5. Fit the side direction indicator.
6. Fit the fender noise-absorbing lining.
7. Fit the quarter window pad assembly.
8. Fit the front bumper.

Front Bumper

9. Fit the front wheel splash shield.

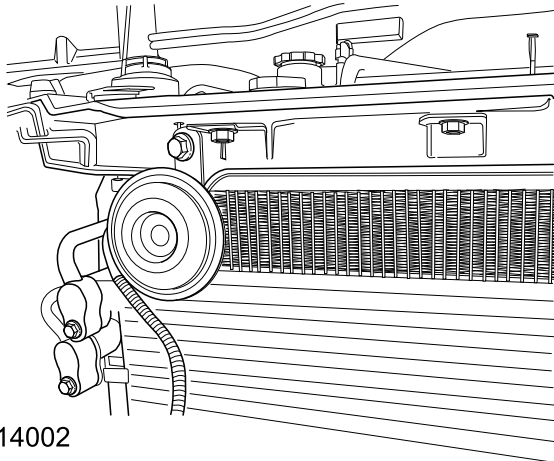
Modular Front End Panel

Removal

1. Remove the front bumper.

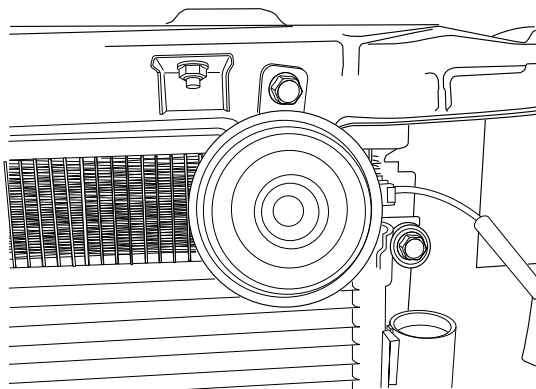
 **Front Bumper**

2. Remove the 1 screw securing the horn LH to the modular front end panel.



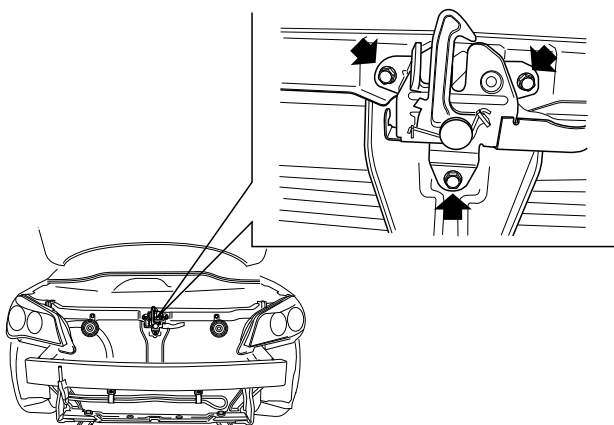
S114002

3. Remove the 1 screw securing the horn RH to the modular front end panel.



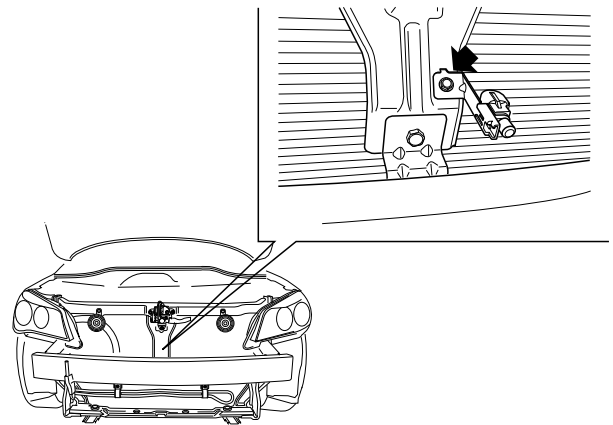
S114001

4. Remove the 2 cotter pins securing the air cleaner to the modular front end panel.
5. Remove the 3 bolts securing the bonnet lock body to the modular front end panel.

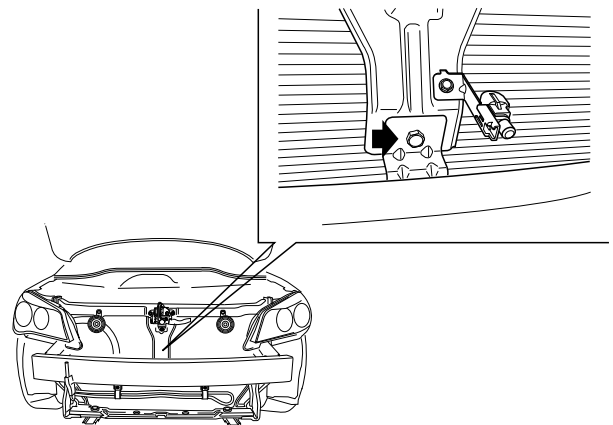


6. Remove the 1 screw securing the temperature sensor

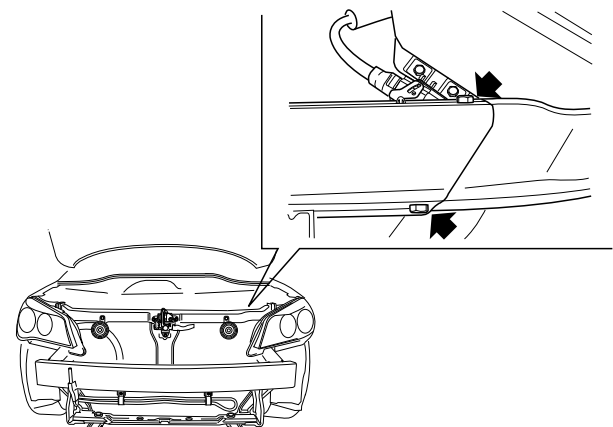
to the modular front end panel.(Only for the advanced configuration)



7. Remove the 1 screw securing the modular front end panel to the front bumper armature assembly.



8. Remove the 2 screws securing the modular front end panel to the bracket RH.



9. Remove the 2 screws securing the modular front end panel to the bracket LH.
10. Lift up the modular front end panel from the body, and then remove the modular front end panel.

Refit

1. Position the modular front end panel to the tank.
2. Secure the modular front end panel to the bracket LH

with 2 bolts, and then tighten the bolts to the rated torque **20.9 Nm**, and inspect the torque.

3. Secure the modular front end panel to the bracket RH with 2 bolts, and then tighten the bolts to the rated torque **20.9 Nm**, and inspect the torque.
4. Secure the modular front end panel to the front bumper armature assembly with 1 screw.
5. Secure the bonnet lock body to the modular front end panel with 3 bolts, and then tighten the bolts to the rated torque **7-10 Nm**, and inspect the torque.
6. Secure the air cleaner to the modular front end panel with 2 cotter pins.
7. Adjust the cooperation condition of the bonnet, and inspect the operability of the bonnet lock body.
8. Secure the horn LH to the modular front end panel with 1 screw.
9. Secure the horn RH to the modular front end panel with 1 screw.
10. Fit the front garnish to the modular front end panel with 6 screws.
11. Fit the front bumper.

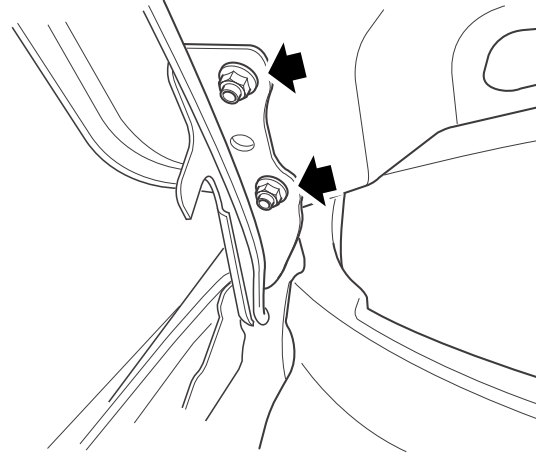
 **Front Bumper**

Bonnet Assembly

Removal

Warning: Take special attention to avoid vehicle damage and personal injury

1. Open and support the bonnet securely.



2. Unscrew the 4 nuts securing the bonnet to the bonnet hinges on both sides.
3. Remove the bonnet with the help of an assistant.

Refit

Warning: Bonnet will drop by its own weight during removal and refit, so make sure to support it safely

1. Fit and position the bonnet to the vehicle with your assistant.

Caution: DO NOT damage the thread on the bolt when inserting the bolt into the fit hole.

2. Fit the 4 nuts securing the bonnet to the bonnet hinges on both sides, and tightening torque should not be too excessive.
3. Check alignment of bonnet against both front fenders and bonnet platform.
4. Tighten all of the nuts with the rated torque to **19-25 Nm**, check the torque and close the bonnet.

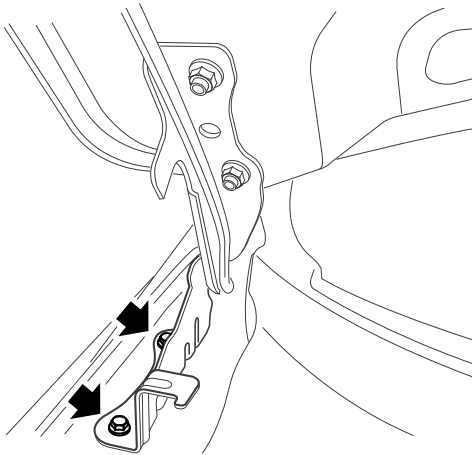
Bonnet Hinge Assembly**Removal**

Warning: Take special attention to avoid vehicle damage and personal injury

1. Mark the position of the hinges relative to the bonnet, which is used for alignment when fitting them.
2. Remove the bonnet with the help of an assistant.

👉 Bonnet Assembly

3. Unscrew the 4 bolts from the connected parts of the body hinges on both sides and body front end.



4. Remove the hinges on both sides.

Refit

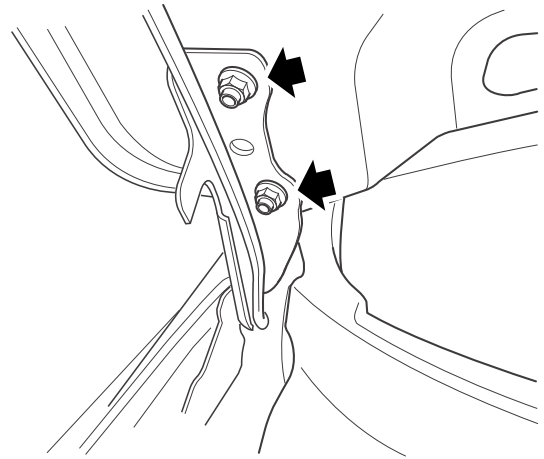
1. Position the body hinges on both sides on the body front end correctly and respectively, and align the hinges with the position marked when removing them.
2. Fit the bolts of the body hinges on both sides, and then tighten the bolts to the rated torque **26-34 Nm**, and inspect the torque.
3. Fit the bonnet with the help of an assistant.

👉 Bonnet Assembly

Warning: Bonnet will drop by its own weight during removal and refit, so make sure to support it safely

Adjustment of Bonnet**Adjustment**

1. Use non permanent marker to mark the outer profile of the hinge and body hinge on the bonnet.
2. Loosen the nut securing the bonnet hinge to the bonnet.

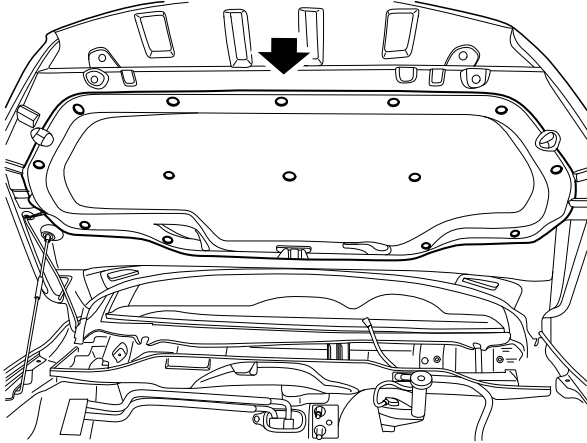


3. Adjust the position of the bonnet to align the bonnet with the front fender.
4. Tighten the nut on the bonnet hinge to **19-25 Nm**, and inspect the torque.
5. Loosen the bolt securing the body hinge to the body.
6. Adjust the position of the bonnet at lateral and front/rear direction to align the bonnet with the front fender, and the front corner of the bonnet should be horizontal with the front fender.
7. Tighten the bolt of the body hinge to **26-34 Nm**, and inspect the torque.

Bonnet Sound-insulating Mat

Removal

1. Open and support the bonnet securely.
2. Pry the 14 snap fits from the bonnet sound-insulating mat carefully.



3. Remove the bonnet sound-insulating mat.

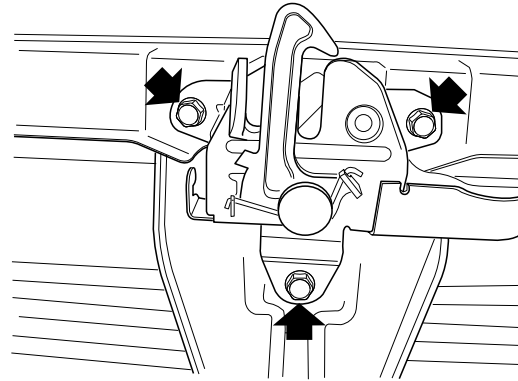
Refit

1. Position the bonnet sound-insulating mat to the bonnet inner panel.
2. Secure the sound-insulating mat to the bonnet with 14 snap fits.
3. Close the bonnet.

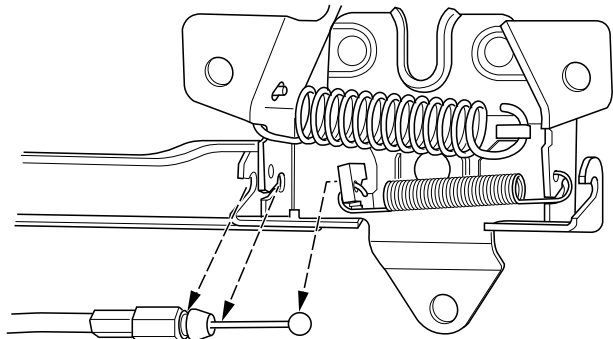
Bonnet Lock Body Assembly

Removal

1. Open and support the bonnet securely.
2. Mark the position of the lock body on the modular front end panel bracket, which is used for alignment when fitting it.



3. Unscrew the 3 bolts and loosen the bonnet lock body from the modular front end panel.
4. Detach the bonnet cable assembly from the lock body assembly to remove the lock body assembly.



Refit

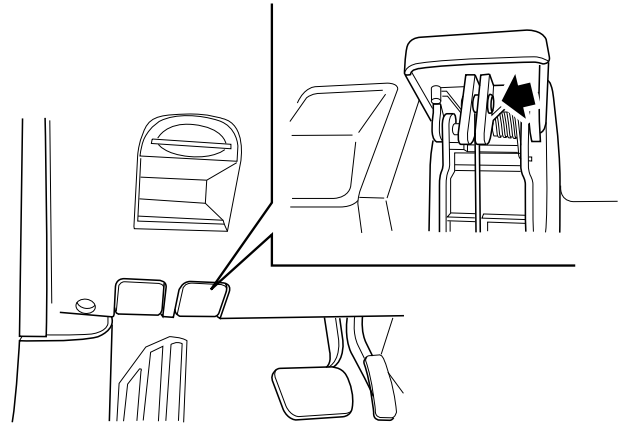
1. Connect the bonnet cable assembly to the lock body assembly securely, namely, put the ball end of the cable core wire into the stop hook groove on the bonnet lock body and the core wire into the long groove on the bonnet lock housing respectively, and align the ring groove on the main cable protector pipe end with the mounting groove on the lock case, then firmly push it until a "click" sound is heard.
2. Position the bonnet lock body assembly to the modular front end panel bracket again and align the assembly with the position marked when removing it.
3. Secure the lock body assembly to the modular front end panel bracket with 3 bolts, but DO NOT tighten the bolts to the rated torque.

4. Close the bonnet, observe the relative position of the lock and the striker, then adjust the position of the lock body to make sure that the striker can enter the tab smoothly.
5. After adjustment, tighten the 3 bolts to the rated torque **7-10 Nm**, and inspect the torque.
6. Close the bonnet.

Bonnet Release Cable

Removal

1. Open the bonnet and support it securely with the strut bar.
2. Pull out the column shape end of the bonnet cable assembly and the ring groove on the end of the cable protector pipe out respectively from the column hole of the opener handle and the mounting slot, as shown by the arrow.

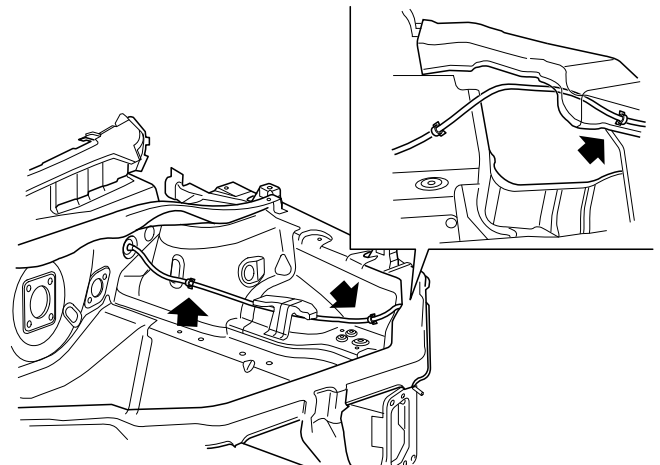


3. Remove the bonnet lock body.

Bonnet Lock Body Assembly

4. Pry the 3 snap fits securing the cable assembly in the engine bay carefully to remove the cable assembly.

Caution: The bonnet cable assembly can only be pulled out from the engine bay.



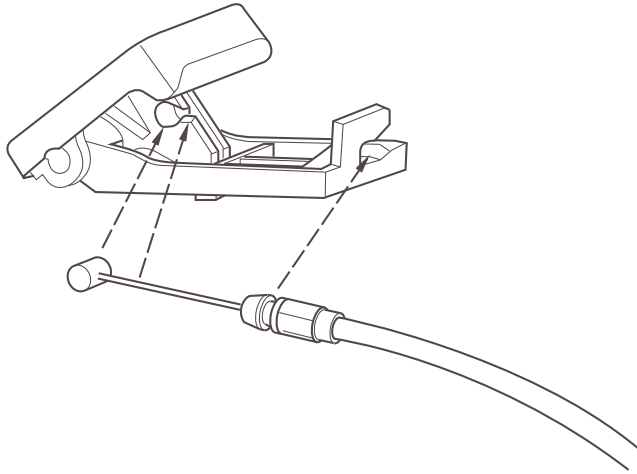
Refit

1. Position the cable assembly into the engine bay, and pass the flat tip into the driver's compartment from the engine bay to the hole on the front compartment partition, and then secure it to the hole on the partition with the rubber seal washer on the cable assembly.

Caution: The bonnet cable assembly can only be pulled out from the engine bay.

2. Insert the column shape end of the cable assembly to the column hole of the opener handle, put the core

wire into the long slot of the handle simultaneously, and align the ring groove on the cable protector pipe end with the mounting groove on the opener handle, then firmly push it until a "click" sound is heard, which indicates that the connection is completed.



3. Fit the bonnet lock body assembly.

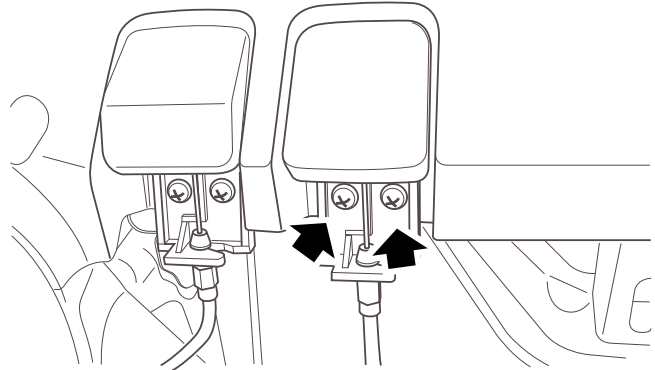
 **Bonnet Lock Body Assembly**

4. Pull the opener handle of the bonnet in the driver's compartment to inspect the opening effect of the bonnet.

Bonnet Opener Handle Assembly

Removal

1. Remove the 2 self-tapping screws securing the bonnet opener handle assembly to the body.



2. Pull the bonnet release cable assembly out from the opener handle to remove the bonnet opener handle assembly.

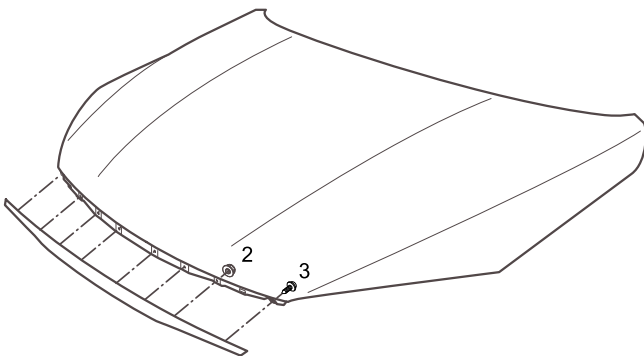
Refit

1. Align the 2 circular mounting holes on the bonnet opener handle assembly base with the 2 mounting holes on the instrument panel, and align the quadrature salience on the instrument panel, and align the quadrature hole on the instrument panel, and make the two fitting surfaces snug.
2. Secure the opener handle to the instrument panel with 2 self-tapping screws, and the torque is **1.3-1.9 Nm**, and inspect the torque.
3. Fit one side of the cable assembly column shape end to the bonnet opener handle assembly.

Bonnet Bright Garnish Assembly**Removal**

1. Open and support the bonnet securely.
2. Remove the 6 nuts in order from middle to the both sides as shown in the illustration (2).
3. Remove the screws on the both sides of the garnish assembly respectively, and remove the garnish assembly as shown in the illustration (3).

Warning: When removing the screws on both ends, pay attention to avoid the injuries, such as cut, and so on, caused by both sharp ends of garnish assembly owing to the rebound force produced when releasing the screws.

**Refit**

1. Align the claws of the bonnet bright garnish assembly on both ends with bonnet and engage them.
2. Begin from the middle. Tighten the 6 nuts in order from middle to the both sides to the torque **2.0-3.0 Nm**, and inspect the torque.
3. Press and hold the both ends with your hands, tighten the self-tapping screws on the both ends in the bonnet garnish assembly and the torque is **1.5-2.0 Nm**, and inspect the torque.
4. Check the gap and platform.
5. After the adjustment is as specified, close the bonnet.

Rear Closures**Specifications****Torque**

| Description | Value |
|---|--------------|
| Bolt - Trunklid Assembly | 7-10 Nm |
| Bolt-Trunklid Hinge | 7-10 Nm |
| Bolt - Trunklid Lock Body | 7-10 Nm |
| Bolt - Trunklid Striker | 7-10 Nm |
| Hexagon Bolt- Fuel Filler Door and Body | 7.85-12.0 Nm |

Service Procedures

Trunklid Assembly

Removal

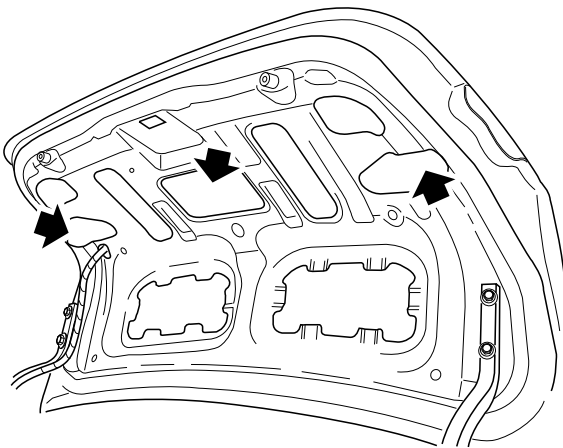
1. Disconnect the battery negative terminal.
2. Open the trunklid.
3. Remove the trunklid gasket.

Trunklid Gasket

4. Remove the trunklid lock body assembly.

Trunklid Lock Body Assembly

5. Carefully pry up the wire harness snap fits fixed on the trunklid inner panel, and disconnect 3 interfaces from taillamps and license plate lamps, and then pull the wire harness out of the trunklid inner panel.



6. If this trunklid needs reassembling, place a mark on the hinge as a reference position.
7. Unscrew the 4 bolts securing the hinges on both sides to the trunklid, and remove the trunklid with the help of an assistant.

Refit

1. Position the trunklid to the body with the help of an assistant, and secure it to the hinges on both sides with 4 bolts and DO NOT tighten.
2. Insert the wires to the trunklid inner panel and connect each of the interface on the wires, and then secure the wires to the trunklid inner panel with the snap fit.
3. Fit the trunklid lock body assembly.

Trunklid Lock Body Assembly

4. Check alignment of trunklid against both bodyside and rear body platform. After adjustment, tighten the bolt to the torque **7-10 Nm**, and check the torque.
5. Fit the trunklid gasket.

Trunklid Gasket

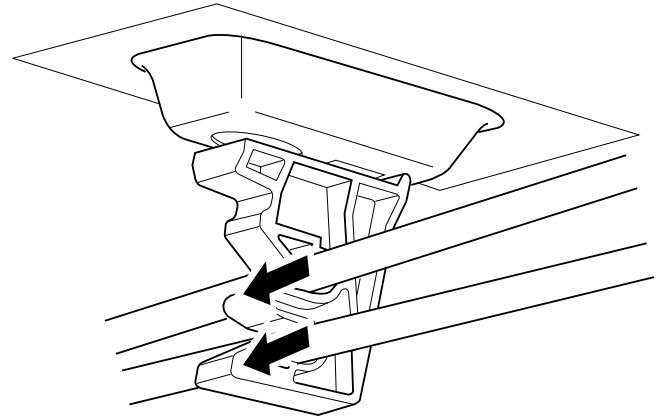
6. Connect the battery negative terminal.

Trunklid Torsion Bar Spring

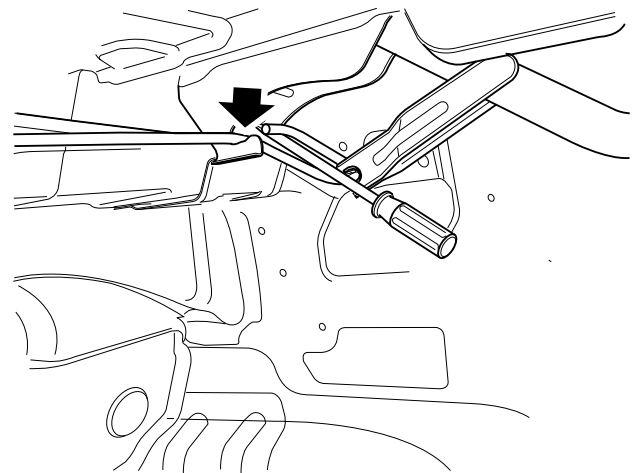
Removal

Note: The one with a green mark is the left torsion bar, the rotating end of which is on the left side; the one with a yellow mark is the right torsion bar, the rotating end of which is on the right side.

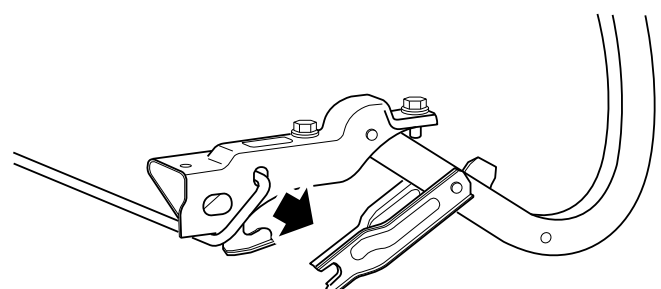
1. Fully open the trunklid, and confirm the rubber block on the hinge is fitted properly.
2. Detach the 2 torsion springs from the torsion set snap fit.



3. Use the large size flat-head screwdriver to press the right end of the right torsion bar with yellow mark (U-toggle rotating end), detach it from the hinge connecting rod, and remove it from the hook (As shown by the arrow) of the centre of gyration for the torsion bar in the hinge, as shown in the illustration.



4. And then pull out the left end of the right torsion from the fixed hole of the left hinge to fully remove the right torsion bar.



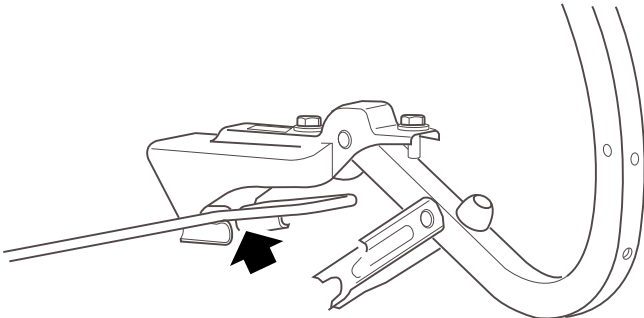
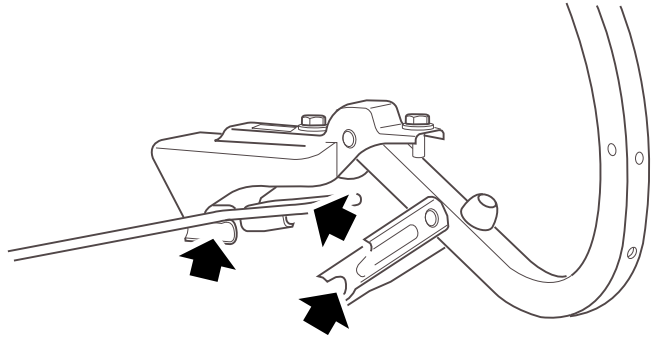
- Use the similar procedures to 3 and 4, fully remove the left torsion.

Refit

Note: The one with a green mark is the left torsion bar, the rotating end of which is on the left side; the one with a yellow mark is the right torsion bar, the rotating end of which is on the right side.

Caution: Be sure that the trunklid fully opens when fitting the torsion bar spring to reduce the force for fitting the torsion bar spring.

- Fully open the trunklid, and confirm the rubber block on the hinge is fitted properly.
- Engage the fixed end of the right torsion bar with yellow mark to the fixed hole on the left side of the trunklid hinge, and make sure that the fixed end is fully against the hinge, and the torsion bar cannot move to the movable end.
- Use the large size flat-head screwdriver to press the U-crank rotating end of the right torsion bar spring, and position it to the hook of the centre of gyration for the torsion bar in the right trunklid hinge, as shown in the illustration.



- Press the U-crank of the torsion spring firmly and rotate the link on the hinge upward lightly to engage the torsion to the groove of the link.
- Use the similar procedures to 2 to 4, fit another torsion spring LH with green mark.
- Engage the 2 torsion springs to the torsion set snap fits. Engage the torsion bar spring whose torsion bar is positioned on its upper part with the upper bayonet of the snap fit, and on its lower part with the lower bayonet of the snap fit.
- Apply the grease to the areas where the rotating end of the torsion bar contacts with the hinge (There are 3 portions, as shown by the arrow) with 1g grease for each portion. After applying 6 areas, it is necessary to open and close the boot several times, and ensure the grease sufficiently leaks into the friction area between the torsion bar spring and hinges.

Caution: DO NOT apply grease to the set end of the torsion bar spring.

Trunklid Hinge Assembly**Removal**

Warning: Take special attention to avoid vehicle damage and personal injury

1. Disconnect the battery negative terminal.
2. Remove the trunklid torsion bar spring.

Trunklid Torsion Bar Spring

3. Remove the trunklid gasket.

Trunklid Gasket

4. Carefully pry up the wire harness snap fits fixed on the trunklid inner panel, and disconnect 4 interfaces from taillamps, license plate lamps and trunklid lock on the wire harness, and then pull the wire harness out of the trunklid inner panel.
5. Unscrew the 4 bolts securing the hinges on both sides to the trunklid, and remove the trunklid with the help of an assistant.
6. Remove the rear parcel shelf assembly.

Rear Parcel Shelf

7. Remove the 6 bolts securing the hinges to the body from both sides of the interior vehicle body.

Rear Parcel Shelf

3. Position the trunklid to the body with the help of an assistant, and secure it to the hinges on both sides with 4 bolts and DO NOT tighten.

Trunklid Assembly

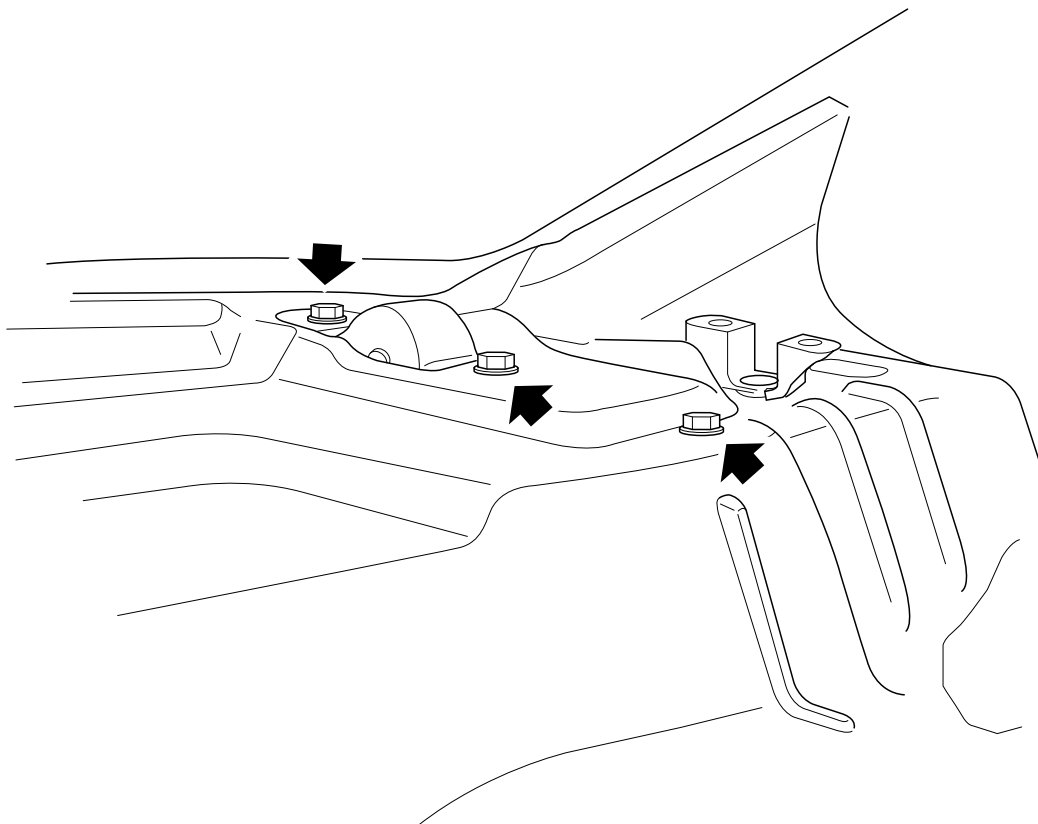
4. Insert the wires to the trunklid inner panel and connect each of the interface on the wires, and then secure the wires to the trunklid inner panel with the snap fit.
5. Check alignment of trunklid against both bodyside and rear body platform. After adjustment, tighten the bolt to the torque **7-10 Nm**, and check the torque.
6. Fit the trunklid gasket.

Trunklid Gasket

7. Fit the trunklid torsion bar spring.

Trunklid Torsion Bar Spring

8. Connect the battery negative terminal.



8. Remove the hinges on both sides.

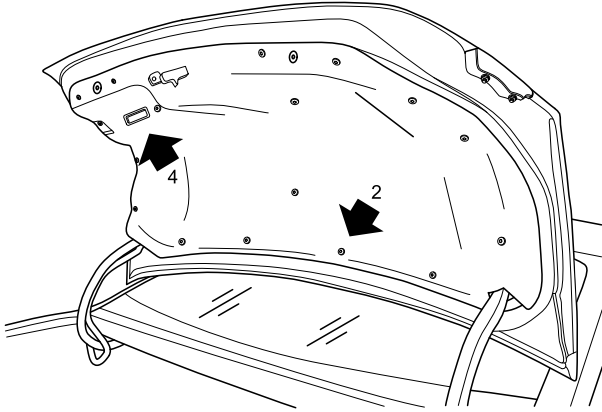
Refit

1. Position the hinges on both sides to the body, fit the bolts and tighten to **7-10 Nm**, and check the torque.
2. Fit the rear parcel shelf assembly.

Trunklid Gasket

Removal

1. Open the trunklid.
2. Carefully pry up the 17 snap fits on the trunklid gasket as shown in the illustration (2).



3. Separate the gasket from the trunklid inner panel.
4. Carefully pry up the upper and lower bases of manual emergency cable to completely separate the manual emergency cable and the gasket as shown in the illustration (4).
5. Lastly, remove the gasket.

Refit

1. Fit the upper and lower bases of manual emergency cable to the gasket first.
2. And then secure the trunklid gasket to the trunklid inner panel with the snap fit.
3. Close the trunklid.

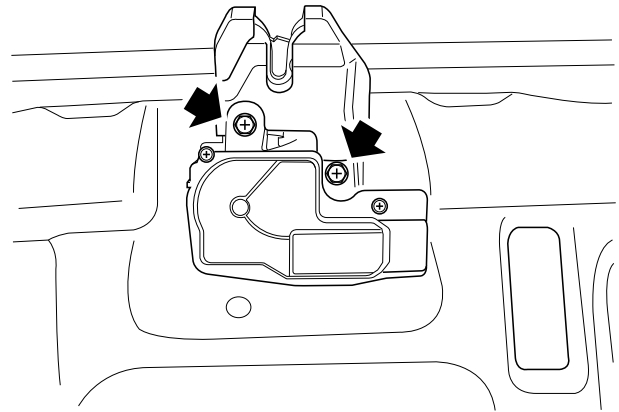
Trunklid Lock Body Assembly

Removal

1. Disconnect the battery earth lead.
2. Remove the trunklid gasket.

 **Trunklid Gasket**

3. Unscrew the 2 bolts securing the trunklid lock body to the trunklid.



4. Carefully pry up the wire harness snap fits from the inner panel holes, and remove the connecting interface from the lock body assembly and disconnect it.
5. Remove the lock body assembly.

Refit

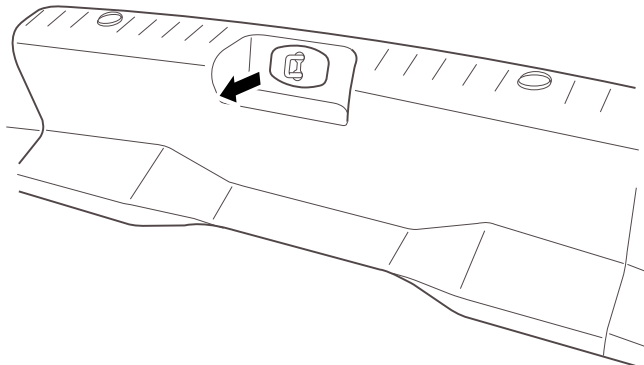
1. Carefully position the lock body assembly onto the trunklid inner panel, fit the bolts and tighten them to the rated torque **7-10 Nm**, and check the torque.
2. Connect the wire harness interface of the lock body assembly to the body wire harness, and position it to the trunklid inner panel with the snap fits.
3. Fit the trunklid gasket.

 **Trunklid Gasket**

4. Close the trunklid.
5. Connect the battery earth lead.

Trunklid Striker**Removal**

1. Open the trunklid.
2. Carefully pry up the striker trim cover.



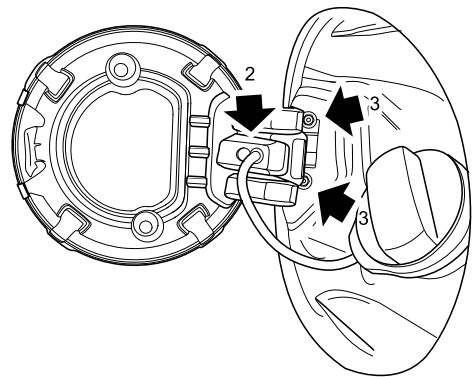
3. Unscrew the 2 mounting bolts from the trunklid striker, and remove the striker simultaneously.

Refit

1. Align 2 bolt holes in the trunklid striker with 2 welding nut holes in the rear body to make both of the fitting surfaces snug.
2. Align the striker line with the body line, and pretighten the bolts.
3. Repeatedly open and close the trunklid (DO NOT lock it up) for several times to centre the striker, in order to avoid friction between the striker and the both sides of boot lock clevis groove, and adjust the upper and lower position of the striker properly to adjust the trunklid platform. After adjustment, tighten the bolts to the rated torque **7-10 Nm**, and check the torque.
4. Close the striker trim cover.
5. Close the trunklid.

Fuel Filler Door Assembly**Removal**

1. Pull up the fuel filler door opener handle under the driver side instrument panel assembly to open the fuel filler door.
2. Release the fuel flap cable from the fuel filler door as shown in the illustration (2).
3. Unscrew the 2 bolts connecting the fuel filler door to the body as shown in the illustration 3, and remove the fuel filler door assembly.

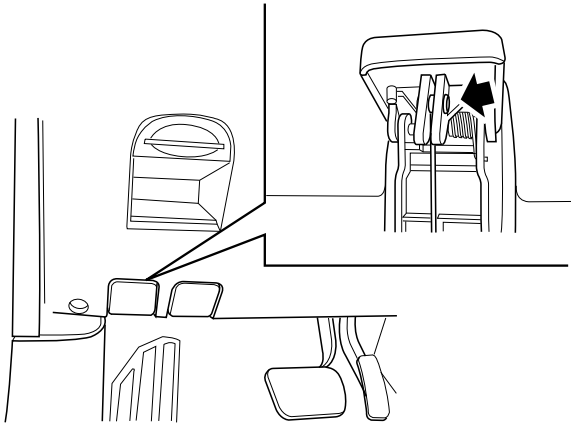
**Refit**

1. Position the fuel filler door to the body, and fit bolts and tighten them to the rated torque **7.85-12.0 Nm**, and check the torque.
2. Engage the fuel flap cable to the fuel filler door, and close the fuel filler door.

Fuel Filler Door Opener Manual Cable Assembly

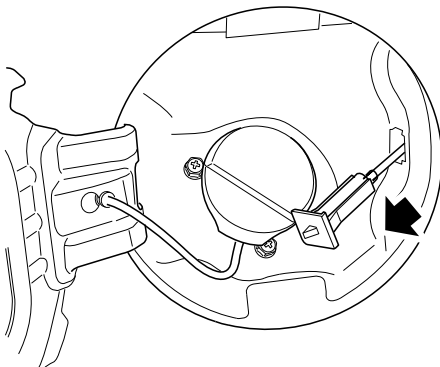
Removal

1. Pull the opener handle of the fuel filler on the driver side instrument lower protector, and open the fuel filler door.
2. Pull the end of the fuel filler door opener cable assembly out of the chips as shown by the arrow.



3. Pry up the fuel filler door opener with a flat-head screwdriver and pull it out.

Caution: The opener plastic part can be damaged but the fuel filler door panel around it should be kept in good condition.



4. Remove the boot side garnish LH.

Hand Icon **Boot Inner Garnish**

5. Remove the C pillar trim panel.

Hand Icon **C Pillar Trim Panel**

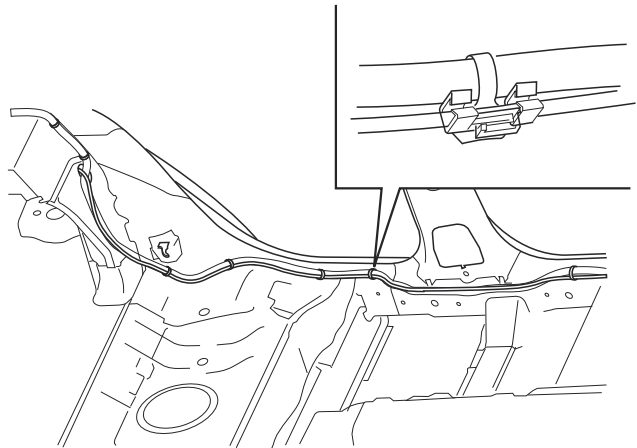
6. Remove the rear door sill trim panel LH.

Hand Icon **Rear Door Sill Trim Panel**

7. Remove the front door sill trim panel LH.

Hand Icon **Front Door Sill Trim Panel**

8. Lift the carpet LH to expose the cable assembly, and release the cable from electrical wire harness snap fits.



9. Pull out the entire fuel filler door opener manual cable assembly from the fuel filler door.

Refit

1. Insert one end of the opener manual cable assembly small end into the boot through the hole on the body side from the the fuel filler door, and push the opener into the hole along the hole axis until a "click" sound is heard and the clips on both sides of the opener are fully engaged into the body side.
2. Pass the cable assembly into the rear of the cabin through the left side of the boot, and secure the cable to the snap fits of the electrical wire harness along the left side of the cabin sill trim panel to the instrument panel in order, and then engage the cylindrical end of the cable assembly into the cutout of the lower instrument opener handle.
3. Fit the boot side garnish LH.

Hand Icon **Boot Side Garnish**

4. Fit the C pillar trim panel.

Hand Icon **C Pillar Trim Panel**

5. Fit the rear door sill trim panel.

Hand Icon **Rear Door Sill Trim Panel**

6. Fit the front door sill trim panel.

Hand Icon **Front Door Sill Trim Panel**

7. Pull the fuel filler door opener handle on the driver side instrument panel assembly lower protector, and check the connection of the opener manual cable assembly.

Horns**Specifications****Torque**

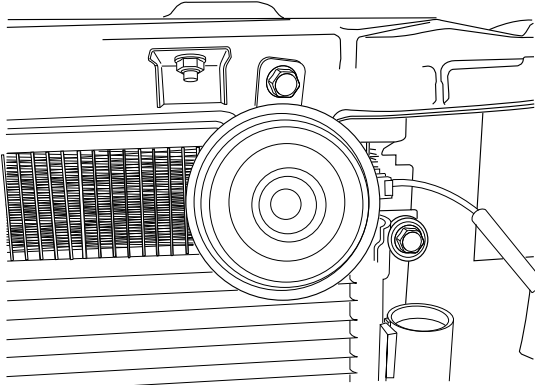
| Description | Value |
|---------------------------------|---------|
| Screw - High Tone Horn Assembly | 8-10 Nm |
| Screw - Low Tone Horn Assembly | 8-10 Nm |

Service Procedures

High Tone Horn

Removal

1. Disconnect the battery earth lead.
2. Remove the front bumper assembly.



S114001

3. Disconnect the electrical connector and remove the high tone horn assembly.

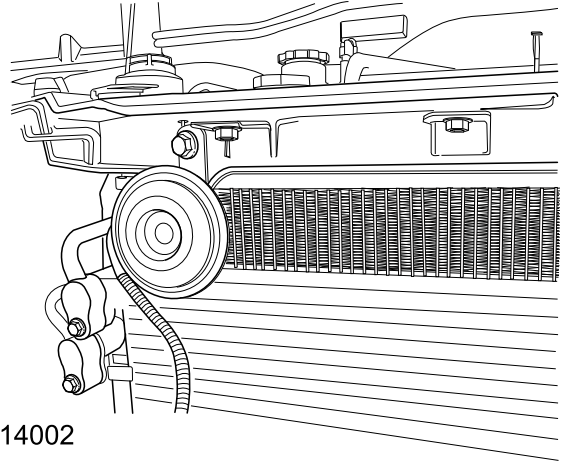
Refit

1. Fit the high tone horn to the modular front end panel and secure with the bolt, and tighten to **8-10 Nm**.
2. Connect the electrical connectors.
3. Fit the front bumper assembly.

Low Tone Horn

Removal

1. Disconnect the battery earth lead.
2. Remove the front bumper assembly.



S114002

3. Disconnect the electrical connectors and remove the low tone horn assembly.

Refit

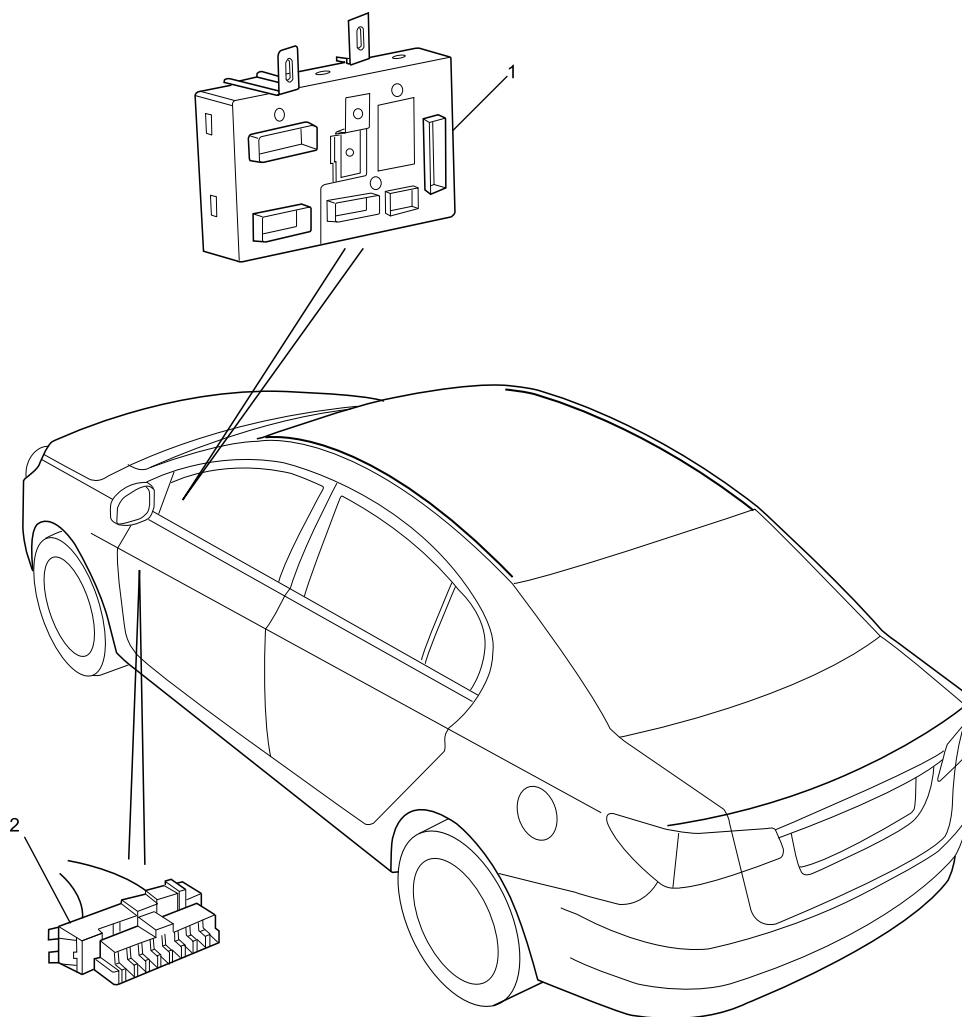
1. Fit the low tone horn to the modular front end panel and secure with the bolt, and tighten to **8-10 Nm**.
2. Connect the electrical connectors.
3. Fit the front bumper assembly.

Body Control Module**Specifications****Torque**

| Description | Value |
|--|--------|
| Bolt - Body Control Module to Instrument Panel Crossmember | 6-8 Nm |

Description and Operation

System Component Layout

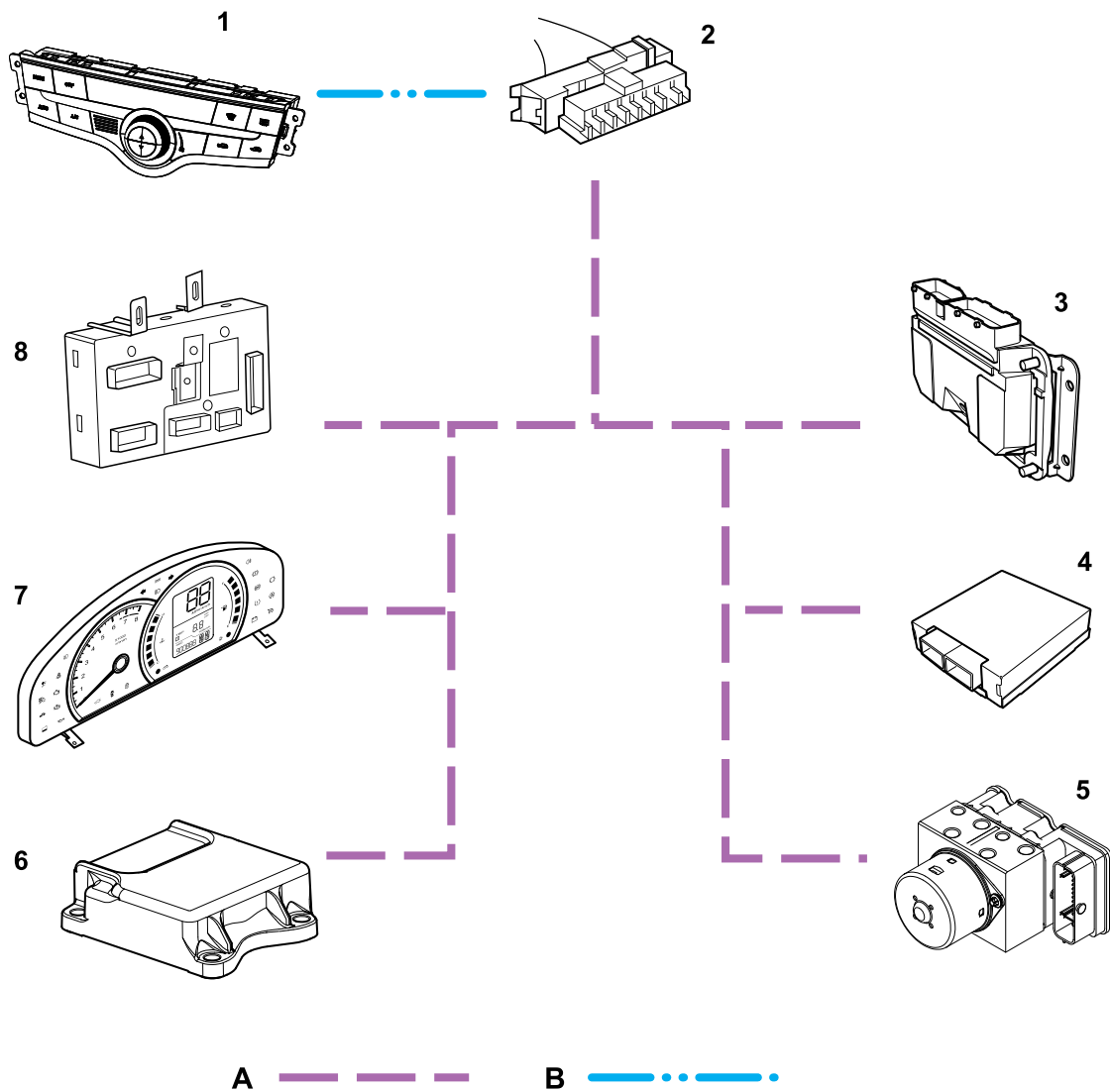


S115001

1. Body Control Module

2. Diagnostic Socket

System Control Diagram



A = High Speed CAN Bus Line; B = K Line

- | | |
|--|--|
| 1. Automatic Air Conditioning Control Unit | 5. ABS/DSC Control Module |
| 2. Diagnostic Socket | 6. Supplementary Restraint System Control Module |
| 3. Engine Control Module | 7. Instrument Pack |
| 4. Automatic Transmission Control Module | 8. Body Control Module |

Description

BCM is located behind the driver side instrument panel. **BCM** is in charge of most control functions of the vehicle, and interacts with the other main electrical systems through the high speed **CAN** bus line, and interacts with the secondary electrical system through the **K** bus line connection. **BCM** is in charge of the power distribution system, and supplies power to most of the electrical components of the vehicle.

Through the high speed **CAN** bus line, the body control module communicates with the following components and they interact with each other:

- Engine Control Module (**ECM**)
- Automatic Transmission Control Module (TCU)
- Supplementary Restraint System Control Module (**SRS ECU**)
- **ABS/DSC** Control Module
- Instrument Pack (Including All Meters and Warning Lights)

ABS/DSC control module connects with the steering angle sensor SAS and yaw rate sensor YRS through the local high speed **CAN** bus line.

Through the **K** bus line, the body control module communicates with the following components and they interact with each other

- Automatic Air Conditioning Control Unit (**ATC**)

Besides, **BCM** controls the operation and information storage in the following assist systems :

- Battery Voltage
BCM receives the load status of the alternator. **CAN** will display this status information which is used to manage the load of the alternator.
- Vehicle Odometer
BCM stores the readings of the vehicle odometer (up to 999999 km). The instrument pack displays the latest maximum reading of odometer. The odometer reading cannot be changed after it is stored.
- Vehicle Identification Number (**VIN**) Memory
VIN is stored in **BCM** and it cannot be changed after the preset distance is reached. **VIN**.
- Vehicle Configuration Information
BCM stores the vehicle configuration information. The vehicle configuration codes contain the vehicle construction information, including the optional components.
- Maintenance Interval Display

BCM stores the maintenance interval data displayed on the instrument pack.

- Diagnostic Code

When the ignition switch is on, **BCM** performs the self-diagnosis inspection, and stores all the corresponding malfunctions detected by the **EEPROM** with the display of diagnostic trouble codes. The malfunctions within the **CAN** and **K** are stored simultaneously.

Program Function

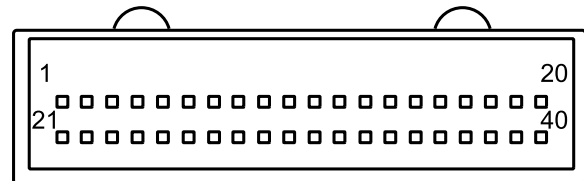
T5 allows to perform the following functions:

- Add a new blank key.
- Disable/enable an existing door key.
- When replacing the **BCM**, obtain the security code from **EMS**.
- When replacing the engine control module (**ECM**), provide the security code to **EMS**.
- When replacing **BCM** and **ECM** simultaneously, a new security code is created.
- Set the battery load management state.
- Refresh the software programs (only on the premise of the manufacturer's guidance).

Body Control Unit Connector

There are four connectors in the body control unit: MG644114, MG644088, MG643335-R00 and MG643314, which provide signal input/output service for the body control unit.

BCM connector MG644114

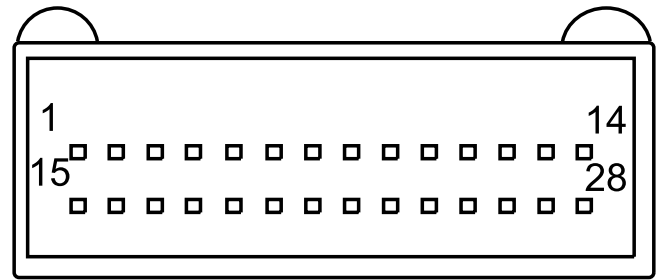


MG644114

| Pin Number | Description |
|------------|-----------------------------------|
| 1 | Exterior Antenna Input |
| 2 | Start Switch Input |
| 3 | Rear Washer Switch |
| 4 | Front Washer Switch |
| 5 | Reserve |
| 6 | Reserve |
| 7 | Rear Window Lifter Disable Switch |

| | |
|----|-------------------------------------|
| 8 | Rear Wiper Return Signal |
| 9 | Rear Wiper Switch |
| 10 | Front Wiper Pattern Select Switch 1 |
| 11 | Direction Indicator Switch RH |
| 12 | Exterior Light Switch 1 |
| 13 | Reserve |
| 14 | Boot Opener Switch |
| 15 | Driver Door Open Warning Switch |
| 16 | Driver Door Key Lock Signal |
| 17 | Main Beam Lamp Blinking Switch |
| 18 | Data Link of IMMO SPI Bus Line |
| 19 | Clock Line of IMMO SPI Bus Line |
| 20 | Bonnet Open Warning Switch |
| 21 | ACC Switch |
| 22 | Ignition Switch |
| 23 | Reverse Switch |
| 24 | Exterior Light Switch 2 |
| 25 | Reserve |
| 26 | Inertia Switch, Wake-up Input |
| 27 | Rear Window Heat Switch |
| 28 | Front Wiper Return Signal |
| 29 | Front Wiper Pattern Select Switch 2 |
| 30 | Emergency Warning Light Switch |
| 31 | Direction Indicator Switch LH |
| 32 | Reserve |
| 33 | Trunklid Open Warning Switch |
| 34 | Passenger Door Open Warning Switch |
| 35 | Driver Door Key Unlock Signal |
| 36 | Main Beam Lamp Switch |
| 37 | Rear Fog Lamp Switch |
| 38 | CAN Bus Line Low |
| 39 | CAN Bus Line High |
| 40 | Reserve |

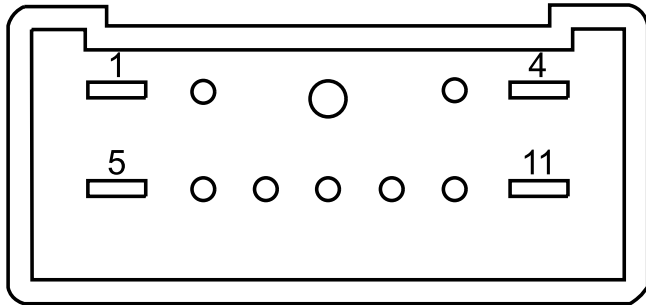
BCM Connector MG644088



| Pin Number | Description |
|------------|--|
| 1 | Rear Window Disable Switch Illumination |
| 2 | Main Beam Relay Coil |
| 3 | Rear Window Heat Relay Coil |
| 4 | Lower the Driver Window |
| 5 | Starter Motor Relay Coil |
| 6 | Raise the Front Passenger Window |
| 7 | Lower the Rear Window RH |
| 8 | Safety Lock Relay Coil |
| 9 | Raise the Driver Window |
| 10 | Reserve Low Side Drive Output 2 |
| 11 | Reserve Low Side Drive Output 4 |
| 12 | Door Lock Status Indicator |
| 13 | Reserve Analog Input |
| 14 | Wiper Interval Time Select Signal |
| 15 | Front Wiper Speed Selection |
| 16 | Rear Wiper Relay Coil |
| 17 | Side Light Coil |
| 18 | Front Wiper Enable Relay Coil |
| 19 | Wiper Analog Quantity Ground |
| 20 | Lower the Rear Window LH |
| 21 | Raise the Rear Window LH |
| 22 | Raise the Rear Window RH |
| 23 | Lower the Front Passenger Window |
| 24 | Reserve Low Side Drive Output 1 |
| 25 | Reserve Low Side Drive Output 3 |
| 26 | Rear Window Heat Switch Status Indicator |

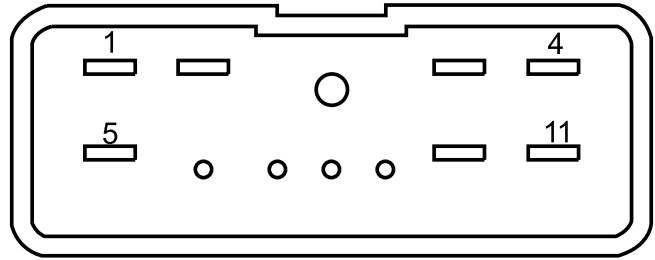
| | |
|----|----------------------------------|
| 27 | Inner Centre Control Lock Switch |
| 28 | Sunroof Auto Close Signal |

BCM Connector MG643335-R00



| Pin Number | Description |
|------------|---------------------------------|
| 1 | Direction Indicator Output RH |
| 2 | Rear Fog Lamp Output |
| 3 | Boot Unlock Output |
| 4 | Front Water Pump Output |
| 5 | Battery Power Source |
| 6 | Room Light Delay Relay Output |
| 7/8 | Window Lifting Function Enabled |
| 9/10 | Rear Window Function Disable |
| 11 | Battery Power Source |

BCM Connector MG643314



| Pin Number | Description |
|------------|-------------------------------|
| 1 | Battery Power Source |
| 2 | Dipped Beam Lamp Output |
| 3 | Door Lock Output |
| 4 | Battery Power Source |
| 5 | Low Current Ground |
| 6 | Direction Indicator Output LH |
| 7 | Room Light PWM Output |
| 8 | Reserve |
| 9 | Warning Request Signal |
| 10 | Door Unlock Output |
| 11 | High Current Ground |

Operation

General

After the ignition switch is turned off, **BCM** can run the safety system, lighting system and diagnostic system. When the ignition switch is in the electronic **AUX** (Auxiliary) position, **BCM** allows the washer/wiper and power window to run simultaneously. When the ignition switch is turned to **IGN** (Ignition) position, the fuel system can be operated. **BCM** communicates and transfers the information with **ECU** between **CAN** and **K** bus line.

BCM can perform management configuration selective operation for a large amount of electrical load. Be sure to decrease the battery consumption when the vehicle is in storage mode, transportation mode or the vehicle is not used for a period of time.

Transportation Mode

Configuring the transportation mode to prevent excessive battery consumption when the vehicle is delivered to the dealer after shipping from the factory. After the vehicle is assembled, programme the **BCM** in order to use the transportation mode during transportation. The transportation mode will keep until the pre-delivery inspection (PDI) is performed. The transportation mode will restrict some electrical functions, for example:

With the use of T5, the dealer can change the vehicle load management configuration from the transportation mode to the normal mode.

Normal Mode

Normal mode is the default setting. The vehicle is used during normal operation after PDI is finished.

Sleep Mode

After turning the ignition switch off, if the battery is still connected, and **CAN** and **K** bus line are in the disable status, **BCM** will keep in the sleep mode to reduce the current consumption as much as possible. **BCM** is ready to receive the **CAN** and **K** bus line signals at all time. During the load mode, it is necessary to turn off some electrical load in order to provide maximum current for the starter motor when the power source is off and the engine is started, such as cutting off the power supply of the air conditioning blower motor, Heated Rear Window (**HRW**), front/rear fog lamp and the main beam headlight. After the engine is started, each electrical load can be reactivated alone to limit the battery current consumption. The electrical load can be reactivated after the following delay. If the starting time is beyond 45 seconds, the starter motor will be detached, and all electrical loads will be turned on simultaneously.

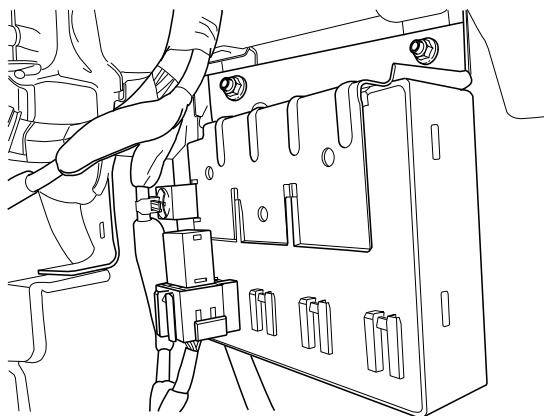
Service Procedures

Body Control Module (BCM)

Removal

1. Disconnect the battery earth lead.
2. Remove the driver side apron board.

Driver Side Apron Board Removal



S115002

3. Remove 2 bolts securing the body control module to the crossmember.
4. Disconnect the electrical connector.
5. Remove the body control module.

Refit

1. Connect the electrical connector.
2. Secure the body control module to the crossmember with 2 bolts, and tighten to **6-8 Nm**.
3. Fit the driver side apron board.

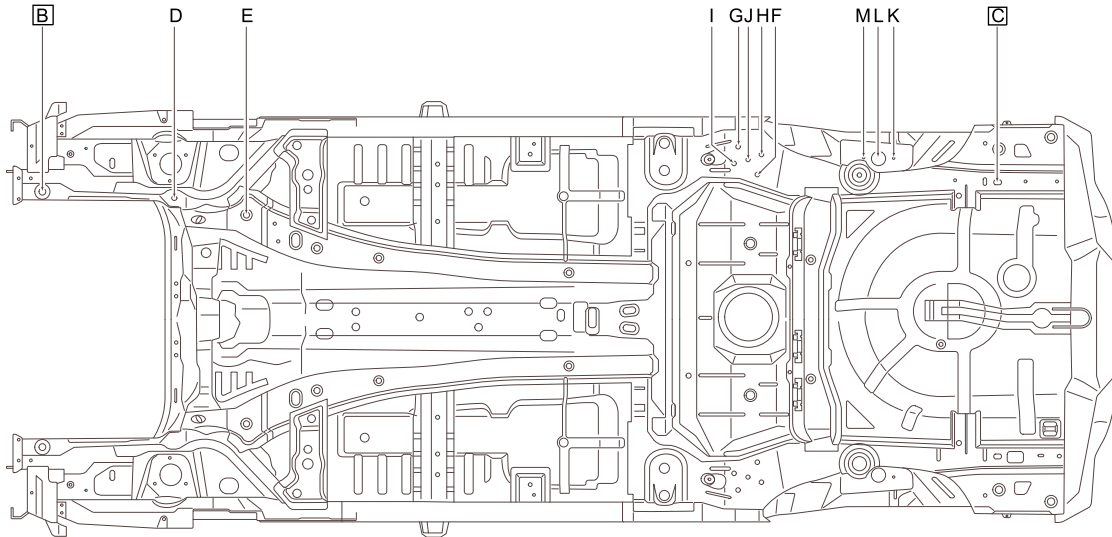
Driver Side Apron Board Refit

4. Connect the battery earth lead.

Body Dimension

Basic Information

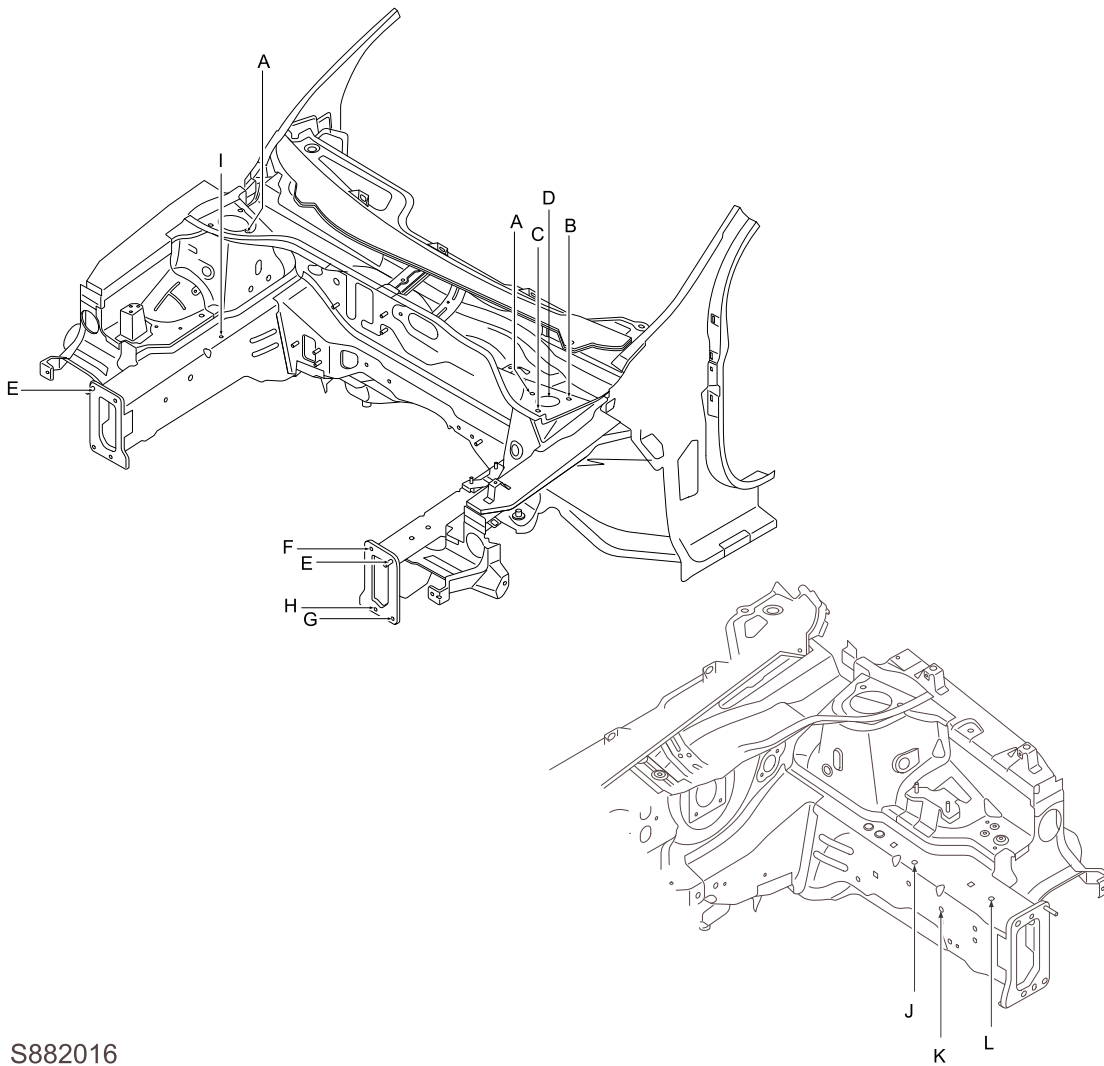
Under Body Information



S882018

| Area | Description | X (mm) | Y (mm) | Z (mm) | Hole Parameter |
|------|------------------------------------|--------|--------|--------|----------------|
| B | (Main Reference) Hole | -400 | -487 | 126 | Φ30 |
| C | (Sub Reference) Hole | 3097 | -500 | 107 | 20*26 |
| D | Front Sub Frame Mounting Hole | 80 | -455 | 94 | M12 |
| E | Front Sub Frame Mounting Hole | 357 | -395 | -69 | M12 |
| F | Rear Torsion Beam Mounting Hole | 2249 | -523 | 11 | M12 |
| G | Rear Torsion Beam Mounting Hole | 2163 | -628 | 11 | M12 |
| H | Rear Torsion Beam Mounting Hole | 2274 | -598 | 18 | M12 |
| I | Rear Torsion Beam Mounting Hole | 2142 | -566 | 5 | M12 |
| J | Rear Torsion Beam Positioning Hole | 2207 | -579 | 11 | Φ11 |
| K | Rear Shock Absorber Mounting Hole | 2702 | -572 | 432 | Φ12 |
| L | Rear Shock Absorber Mounting Hole | 2647 | -572 | 432 | Φ54 |
| M | Rear Shock Absorber Mounting Hole | 2592 | -572 | 423 | Φ12 |

Front End Information

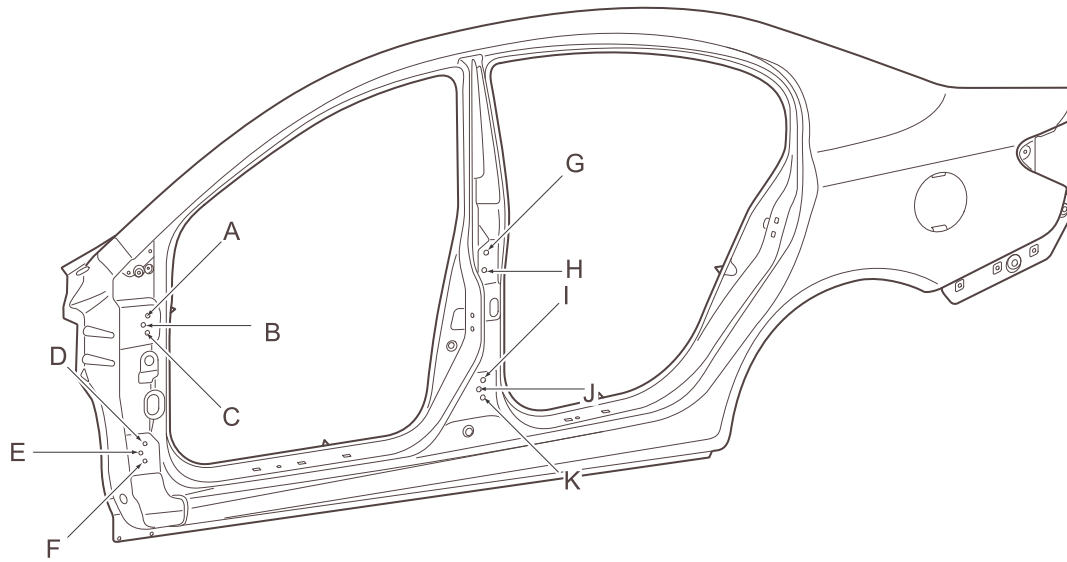


S882016

| Area | Description | X (mm) | Y (mm) | Z (mm) | Hole Parameter |
|------|---------------------------------|--------|--------|--------|----------------|
| A | Front Suspension Shock Absorber | 53 | -526 | 535 | Φ11 |
| B | Front Suspension Shock Absorber | 110 | -623 | 536 | Φ11 |
| C | Front Suspension Shock Absorber | -2 | -623 | 547 | Φ11 |
| D | Front Suspension Shock Absorber | 53 | -591 | 539 | Φ80 |
| E | Front Bumper Armature Assembly | -503 | -562 | 297 | M10 |
| F | Front Bumper Armature Assembly | -503 | -480 | 297 | M10 |
| G | Front Bumper Armature Assembly | -503 | -562 | 105 | M10 |
| H | Front Bumper Armature Assembly | -503 | -497 | 105 | M10 |
| I | Engine Mounting Point | -117 | 480 | 310 | M10 |
| J | Engine Mounting Point | -188 | -484 | 305 | M10 |

| | | | | | |
|---|-----------------------|------|------|-----|-----|
| K | Engine Mounting Point | -294 | -455 | 243 | M10 |
| L | Engine Mounting Point | -385 | -516 | 288 | M10 |

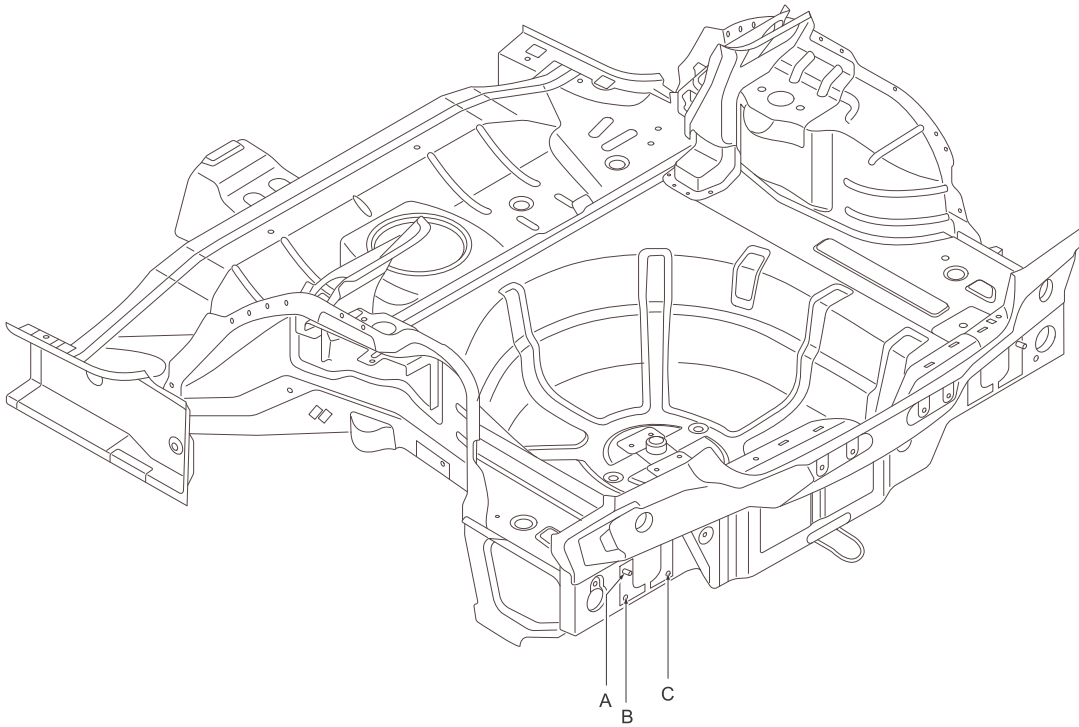
Bodyside Information



S882015

| Area | X (mm) | Y (mm) | Z (mm) |
|------|--------|--------|--------|
| A | 476 | -793 | 523 |
| B | 463 | -794 | 498 |
| C | 475 | -794 | 473 |
| D | 470 | -799 | 155 |
| E | 456 | -799 | 131 |
| F | 469 | -800 | 105 |
| G | 1528 | -796 | 574 |
| H | 1524 | -797 | 524 |
| I | 1519 | -804 | 209 |
| J | 1506 | -804 | 184 |
| K | 1518 | -804 | 159 |

Rear End Information



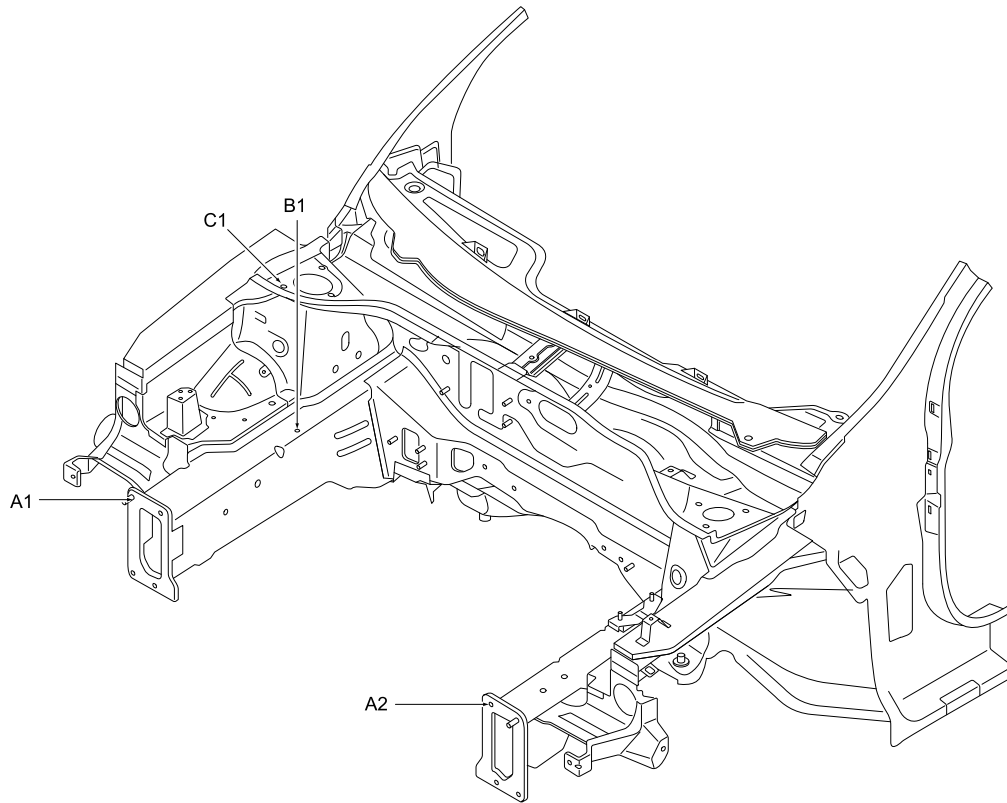
S882014

| Area | Description | X (mm) | Y (mm) | Z (mm) | Hole Parameter |
|------|----------------------------|--------|--------|--------|----------------|
| A | Rear Bumper Mounting Point | 3333 | -567 | 169 | M6 |
| B | Rear Bumper Mounting Point | 3333 | -563 | 93 | M8 |
| C | Rear Bumper Mounting Point | 3333 | -440 | 93 | M8 |

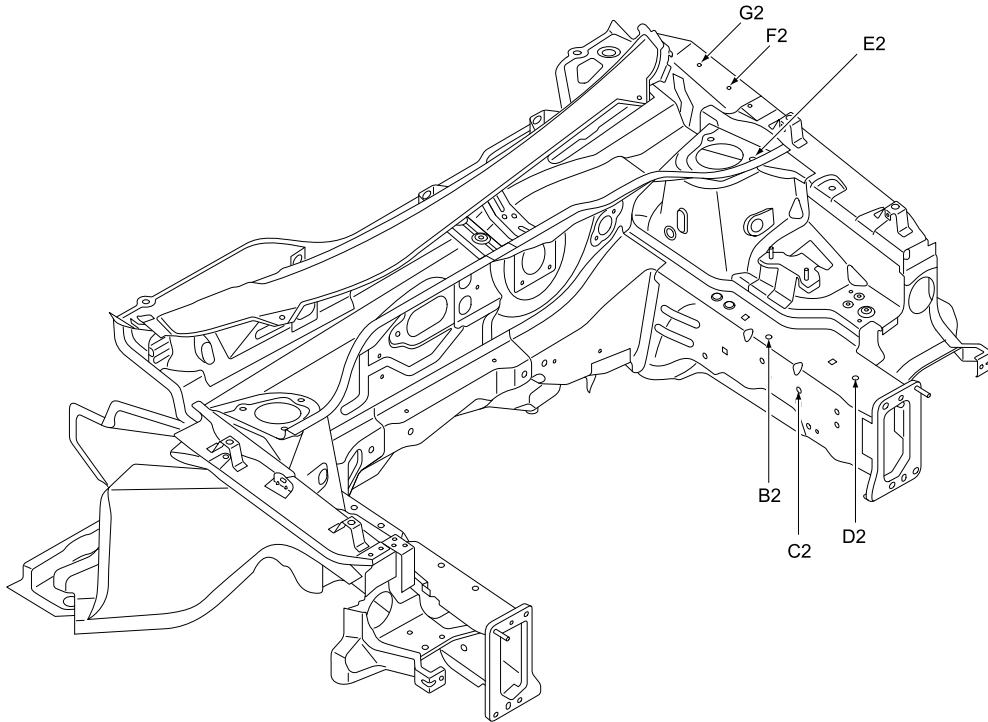
Point-to-point Dimensions Information

Note: All dimensions are for hole/slotted hole centres.

Front End Information



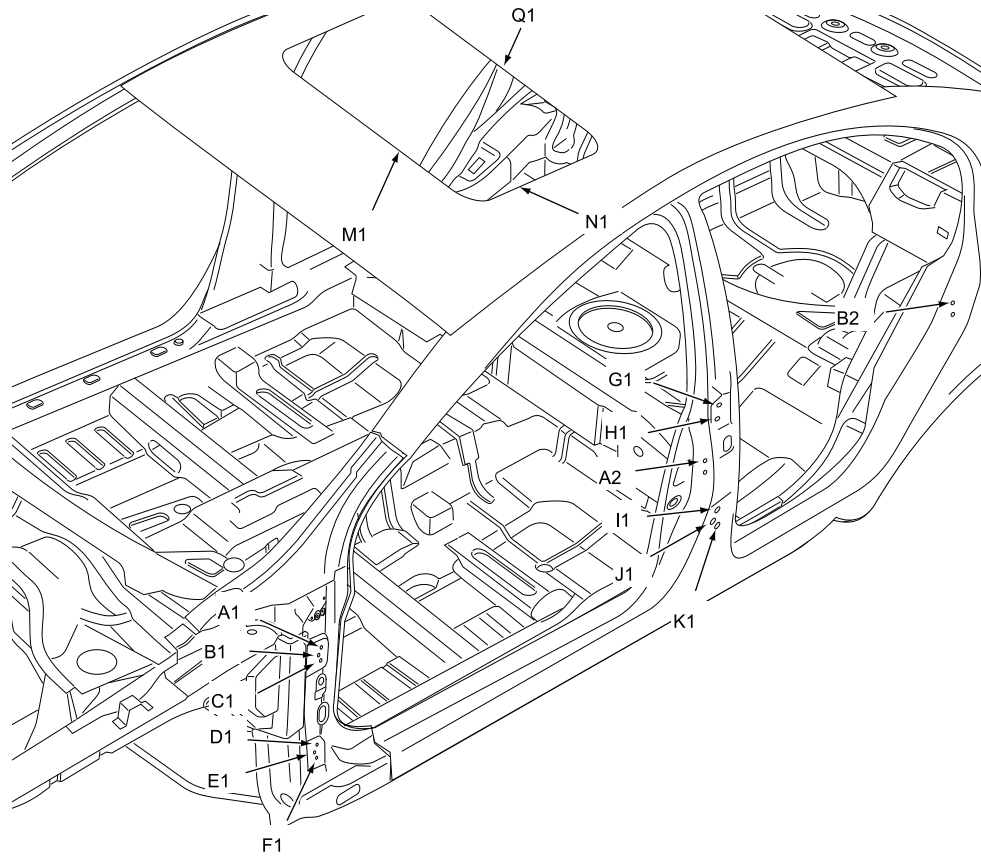
S882013



S882012

| Area | From | To | Length (mm) |
|-------|---|---|-------------|
| A1-A2 | Front Bumper Armature Assembly Mounting Hole - RHS | Front Bumper Armature Assembly Mounting Hole - LHS | 1042 |
| B1-B2 | Engine Mounting Hole RH - RHS | Engine 3rd Mounting Hole LH - LHS | 966 |
| B1-C2 | Engine Mounting Hole RH - RHS | Engine 2nd Mounting Hole LH - LHS | 953 |
| B1-D2 | Engine Mounting Hole RH - RHS | Engine 1st Mounting Hole LH - LHS | 1031 |
| B1-E2 | Engine Mounting Hole RH - RHS | Front Suspension Shock Absorber Mounting Hole - LHS | 1134 |
| B1-F2 | Engine Mounting Hole RH - RHS | Fender Mounting Hole - LHS | 1292 |
| C1-C2 | Front Suspension Shock Absorber Mounting Hole - RHS | Engine 2nd Mounting Hole LH - LHS | 1158 |
| C1-E2 | Front Suspension Shock Absorber Mounting Hole - RHS | Front Suspension Shock Absorber Mounting Hole - LHS | 1247 |
| C1-F2 | Front Suspension Shock Absorber Mounting Hole - RHS | Fender Mounting Hole - LHS | 1392 |
| C1-G2 | Front Suspension Shock Absorber Mounting Hole - RHS | Fender Mounting Hole - LHS | 1406 |

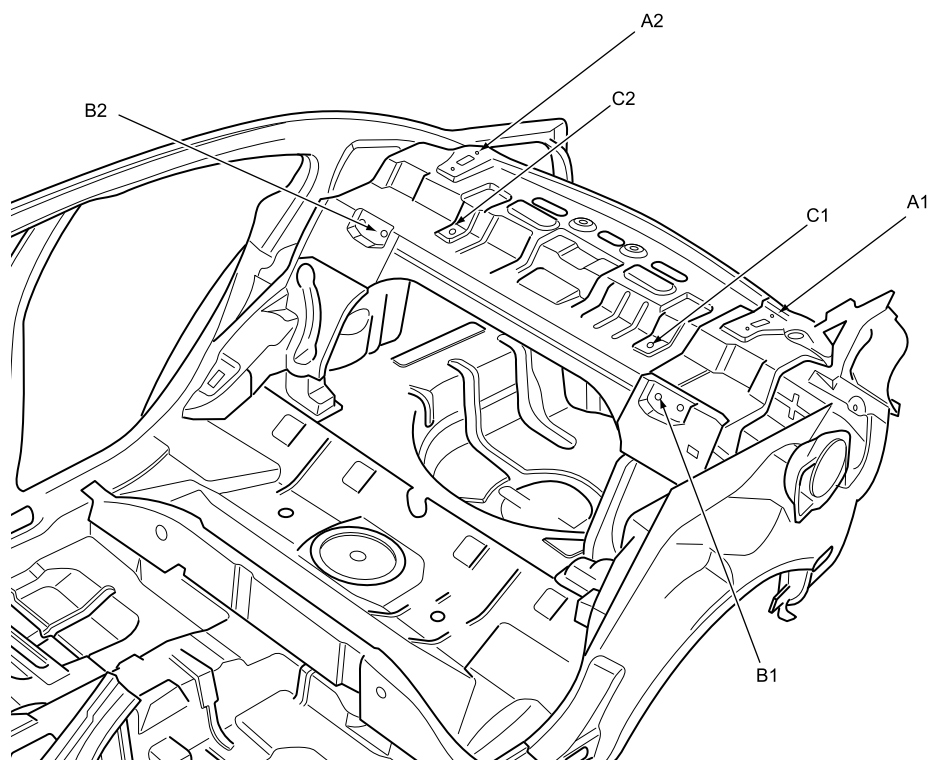
Side and Roof Information



S882011

| Area | From | To | Length (mm) |
|-------|--------------------------------|----------------------------------|-------------|
| A1-A2 | Front Door Hinge Mounting Hole | Front Door Striker Mounting Hole | 1038 |
| B1-A2 | Front Door Hinge Mounting Hole | Front Door Striker Mounting Hole | 1048 |
| C1-A2 | Front Door Hinge Mounting Hole | Front Door Striker Mounting Hole | 1033 |
| D1-A2 | Front Door Hinge Mounting Hole | Front Door Striker Mounting Hole | 1061 |
| E1-A2 | Front Door Hinge Mounting Hole | Front Door Striker Mounting Hole | 1080 |
| F1-A2 | Front Door Hinge Mounting Hole | Front Door Striker Mounting Hole | 1074 |
| G1-B2 | Rear Door Hinge Mounting Hole | Rear Door Striker Mounting Hole | 931 |
| H1-B2 | Rear Door Hinge Mounting Hole | Rear Door Striker Mounting Hole | 934 |
| I1-B2 | Rear Door Hinge Mounting Hole | Rear Door Striker Mounting Hole | 995 |
| J1-B2 | Rear Door Hinge Mounting Hole | Rear Door Striker Mounting Hole | 1016 |
| K1-B2 | Rear Door Hinge Mounting Hole | Rear Door Striker Mounting Hole | 1014 |
| M1-N1 | Sunroof Matching Point | Sunroof Matching Point | 258 |
| M1-Q1 | Sunroof Matching Point | Sunroof Matching Point | 439 |
| N1-Q1 | Sunroof Matching Point | Sunroof Matching Point | 523 |

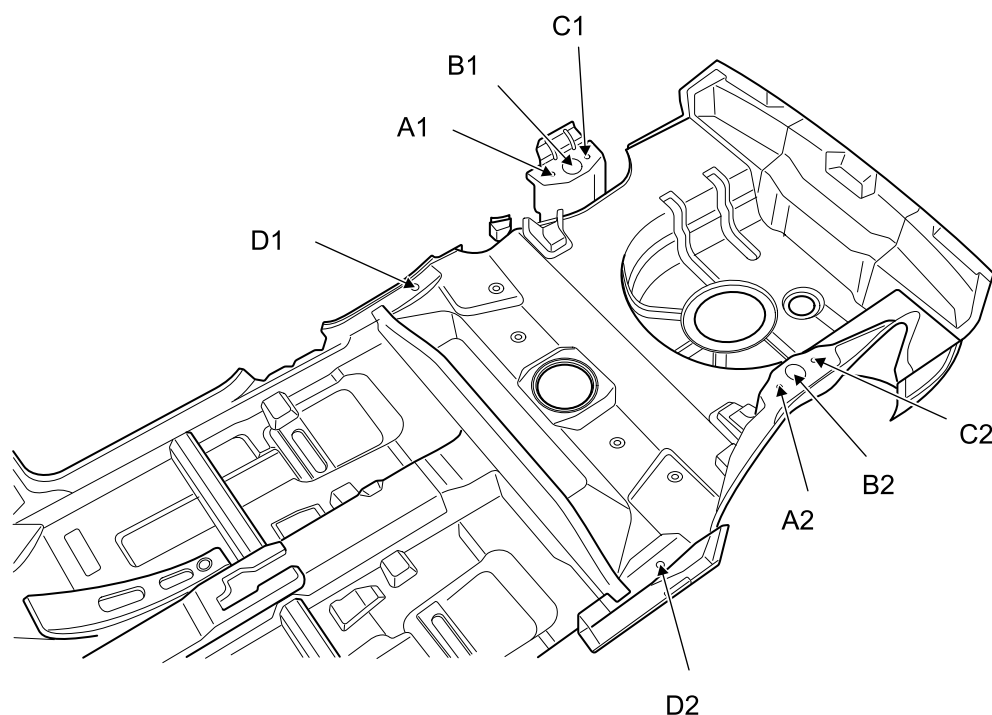
Internal Information



S882010

| Area | From | To | Length (mm) |
|-------|------------------------------------|------------------------------------|-------------|
| A1-A2 | Trunklid Hinge Mounting Hole - RHS | Trunklid Hinge Mounting Hole - LHS | 980 |
| B1-B2 | Rear Seat Mounting Hole - RHS | Rear Seat Mounting Hole - LHS | 937 |
| C1-C2 | Parcel Shelf Assembly - RHS | Parcel Shelf Assembly - LHS | 680 |

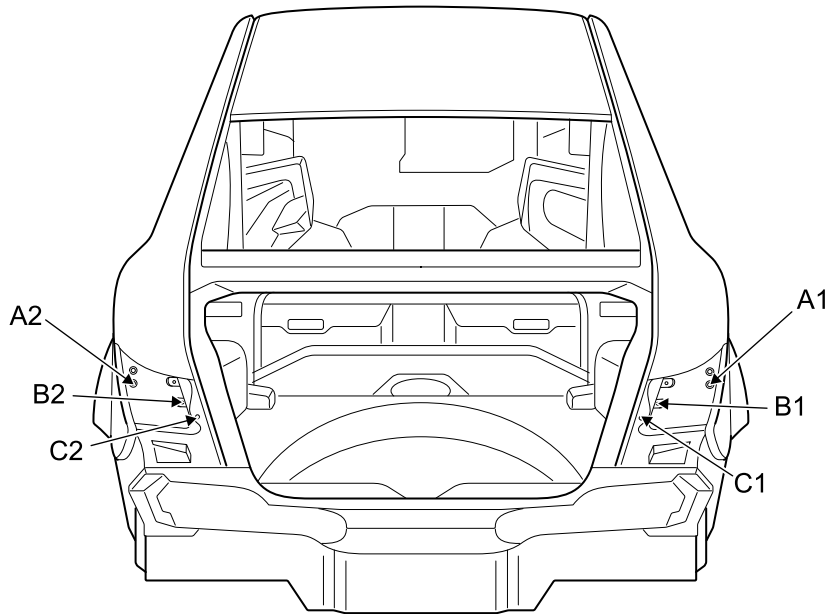
Rear Floor Information



S882009

| Area | From | To | Length (mm) |
|-------|---|---|-------------|
| A1-A2 | Rear Suspension Shock Absorber Mounting Point - RHS | Rear Suspension Shock Absorber Mounting Point - LHS | 1144 |
| B1-B2 | Rear Suspension Shock Absorber Mounting Point - RHS | Rear Suspension Shock Absorber Mounting Point - LHS | 1143 |
| C1-C2 | Rear Suspension Shock Absorber Mounting Point - RHS | Rear Suspension Shock Absorber Mounting Point - LHS | 1143 |
| D1-D2 | Seat Striker Point - RHS | Seat Striker Point - LHS | 1182 |

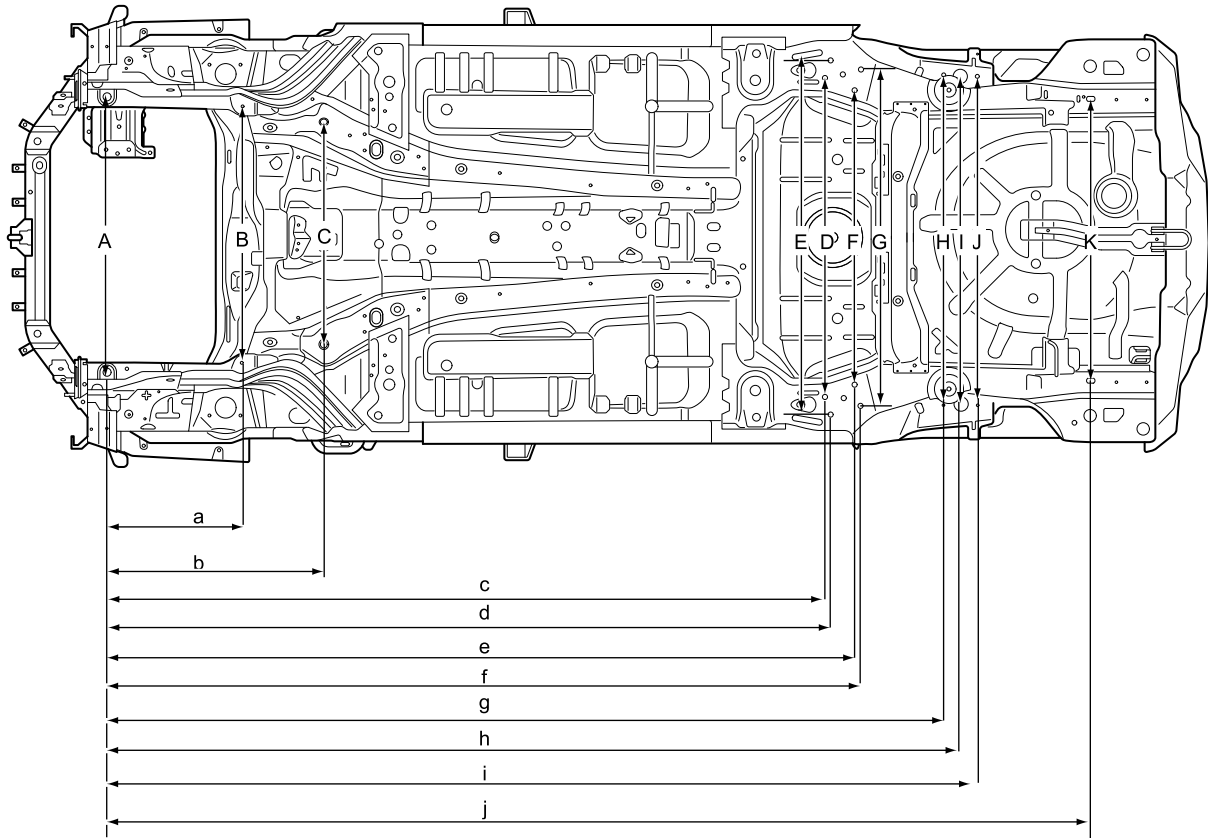
Rear End Information



S882008

| Area | From | To | Length (mm) |
|-------|---------------------------------|---------------------------------|-------------|
| A1-A2 | Rear Light Mounting Hole - RHS | Rear Light Mounting Hole - LHS | 1402 |
| B1-B2 | Rear Light Mounting Hole - RHS | Rear Light Mounting Hole - LHS | 1103 |
| C1-C2 | Rear Bumper Mounting Hole - RHS | Rear Bumper Mounting Hole - LHS | 956 |

Under Body Information



S882007

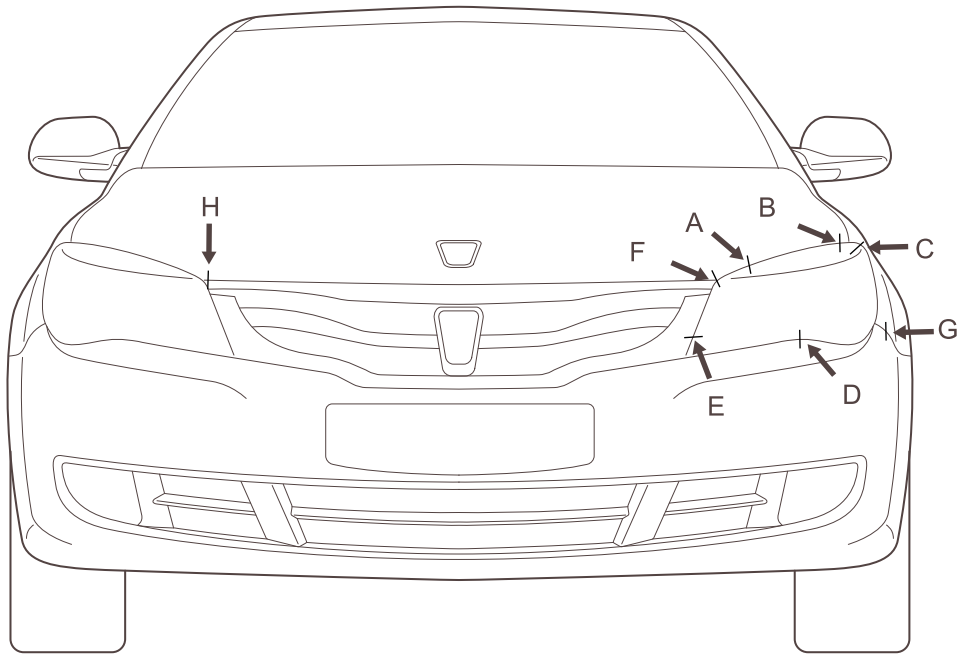
| Area | From | To | Length (mm) |
|------|---|---|-------------|
| A | Main Reference Hole | Main Reference Hole Symmetry Point | 974 |
| B | Front Sub Frame 1st Mounting Hole RHS | Front Sub Frame 1st Mounting Hole LHS | 910 |
| C | Front Sub Frame 2nd Mounting Hole RHS | Front Sub Frame 2nd Mounting Hole LHS | 790 |
| D | Rear Torsion Beam 1st Mounting Hole RHS | Rear Torsion Beam 1st Mounting Hole LHS | 1131 |
| E | Rear Torsion Beam 2nd Mounting Hole RHS | Rear Torsion Beam 2nd Mounting Hole LHS | 1256 |
| F | Rear Torsion Beam 3rd Mounting Hole RHS | Rear Torsion Beam 3rd Mounting Hole LHS | 1046 |
| G | Rear Torsion Beam 4th Mounting Hole RHS | Rear Torsion Beam 4th Mounting Hole LHS | 1196 |
| H | Rear Suspension Shock Absorber 1st Mounting Point RHS | Rear Suspension Shock Absorber 1st Mounting Point LHS | 1144 |
| I | Rear Suspension Shock Absorber Mounting Hole RHS | Rear Suspension Shock Absorber Mounting Hole LHS | 1143 |
| J | Rear Suspension Shock Absorber 2nd Mounting Point RHS | Rear Suspension Shock Absorber 2nd Mounting Point LHS | 1143 |
| K | Sub Reference Hole | Sub Reference Hole Symmetry Point | 1000 |

Body Repair**Body Dimension**

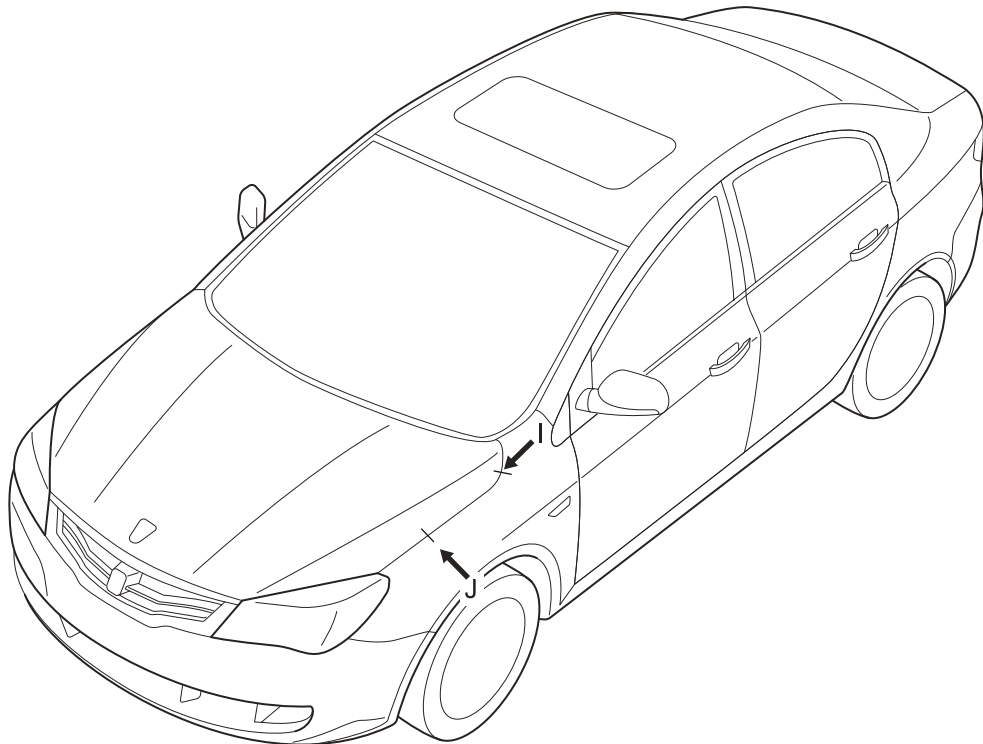
| | | | |
|---|---------------------|---|------|
| a | Main Reference Hole | Front Sub Frame 1st Mounting Hole | 480 |
| b | Main Reference Hole | Front Sub Frame 2nd Mounting Hole RHS | 757 |
| c | Main Reference Hole | Rear Torsion Beam 2nd Mounting Hole RHS | 2542 |
| d | Main Reference Hole | Rear Torsion Beam 1st Mounting Hole RHS | 2563 |
| e | Main Reference Hole | Rear Torsion Beam 3rd Mounting Hole RHS | 2649 |
| f | Main Reference Hole | Rear Torsion Beam 4th Mounting Hole RHS | 2674 |
| g | Main Reference Hole | Rear Suspension Shock Absorber 1st Mounting Point RHS | 2992 |
| h | Main Reference Hole | Rear Suspension Shock Absorber Mounting Hole RHS | 3047 |
| i | Main Reference Hole | Rear Suspension Shock Absorber 2nd Mounting Point RHS | 3102 |
| j | Main Reference Hole | Sub Reference Hole | 3497 |

Gap Information

Front End Information



S882054

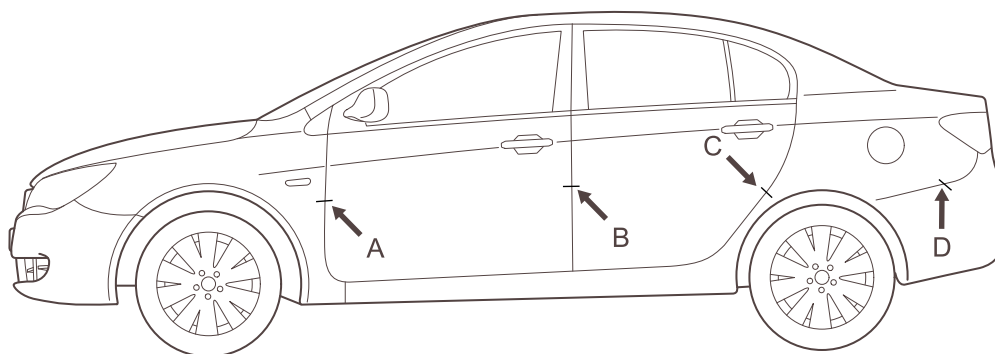


S882002

Gap

| Area | Detailed Description | Gap Dimension (mm) | Outer Profile (mm) |
|------|-----------------------------|--------------------|--------------------|
| A | Bonnet to Headlight | 4.0±1.5 | 0.8±1.0 |
| B | Bonnet to Headlight | 4.0±1.5 | 1.5±1.0 |
| C | Fender to Headlight | 1.5±1.0 | 1.6±1.25 |
| D | Headlight to Front Bumper | 3.0±2.0 | N/A |
| E | Headlight to Grille | 3.0±1.5 | 2.0±1.25 |
| F | Headlight to Bonnet Garnish | 4.0±1.75 | 1.0±1.5 |
| G | Fender to Front Bumper | 0+1/0 | 0.9±0.75 |
| H | Bonnet Garnish to Grille | 7.2+3/0 | 1.0±1.5 |
| I | Fender to Bonnet | 3.7±0.75 | 0-1 |
| J | Fender to Bonnet | 3.0±0.75 | 0+1 |

Bodyside Information

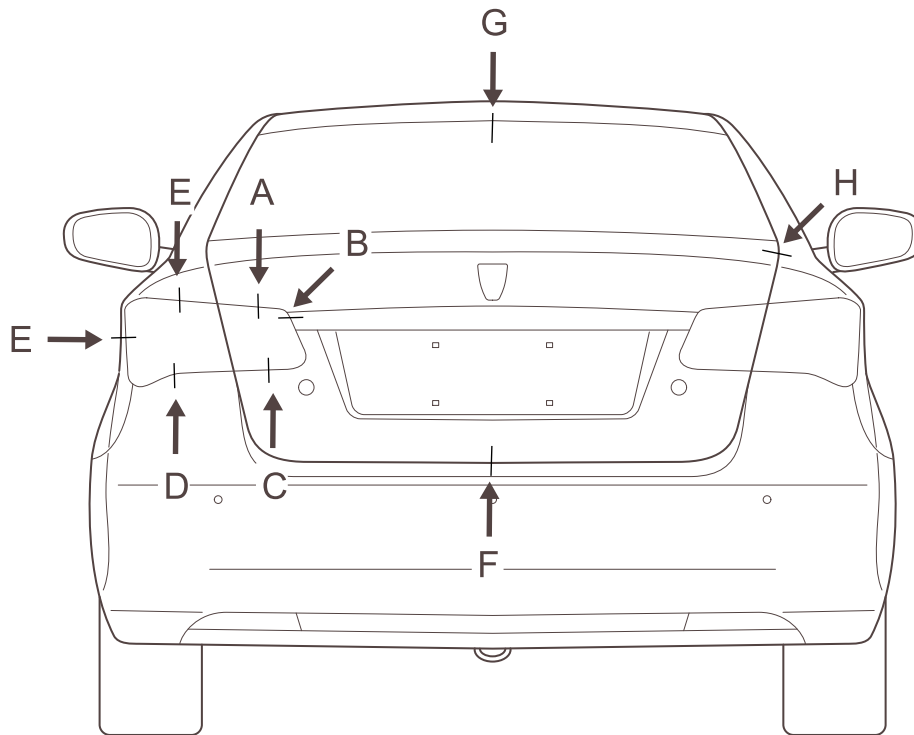


S882003

Gap

| Area | Detailed Description | Gap Dimension (mm) | Outer Profile (mm) |
|------|----------------------------|--------------------|--------------------|
| A | Fender to Front Door | 4.0±0.5 | 0+1/0 |
| B | Front Door to Rear Door | 4.0±0.5 | 0-1/0 |
| C | Rear Fender to Rear Door | 4.0±0.5 | 0-1/0 |
| D | Rear Bumper to Rear Fender | 0+1/0 | 0.9±0.75 |

Rear End Information

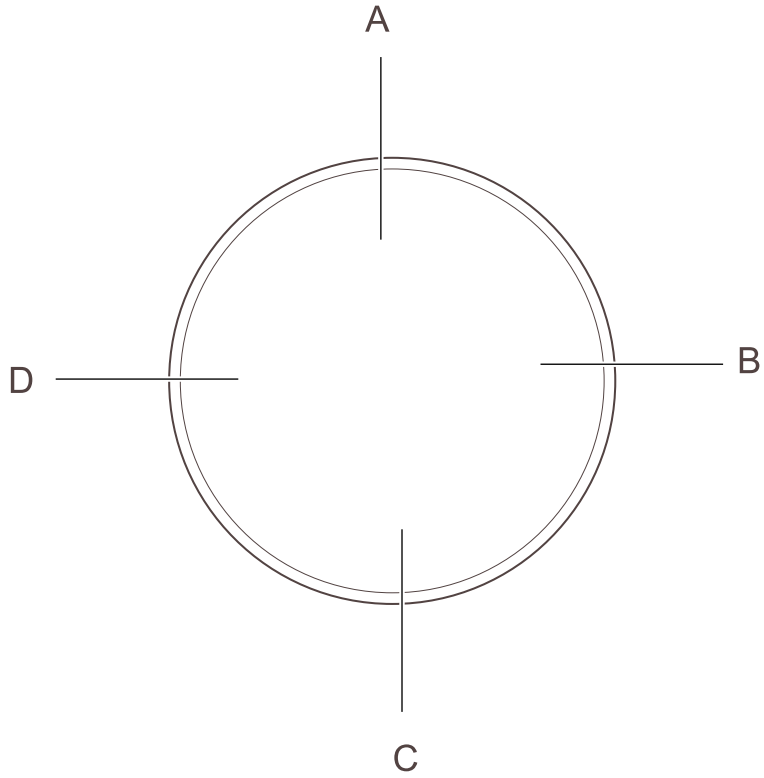


S882004

Gap

| Area | Detailed Description | Gap Dimension (mm) | Outer Profile (mm) |
|------|------------------------------|--------------------|--------------------|
| A | Trunklid to Taillamp | 1.5±0.75 | 1.0±0.5 |
| B | Taillamp to Trunklid Garnish | 1.5±0.75 | N/A |
| C | Trunklid to Taillamp | 2.0±0.75 | -0.5±0.5 |
| D | Rear Bumper to Taillamp | 2.0±0.75 | 0±0.5 |
| E | Rear Fender to Taillamp | 1.5±0.75 | 1.0±0.5 |
| F | Rear Bumper to Boot | 6.0±2.0 | N/A |
| G | Rear Windshield to Roof | 3.0±1.5 | N/A |
| H | Rear Fender to Trunklid | 3.0±0.75 | 0+1 |

Fuel Flap Information

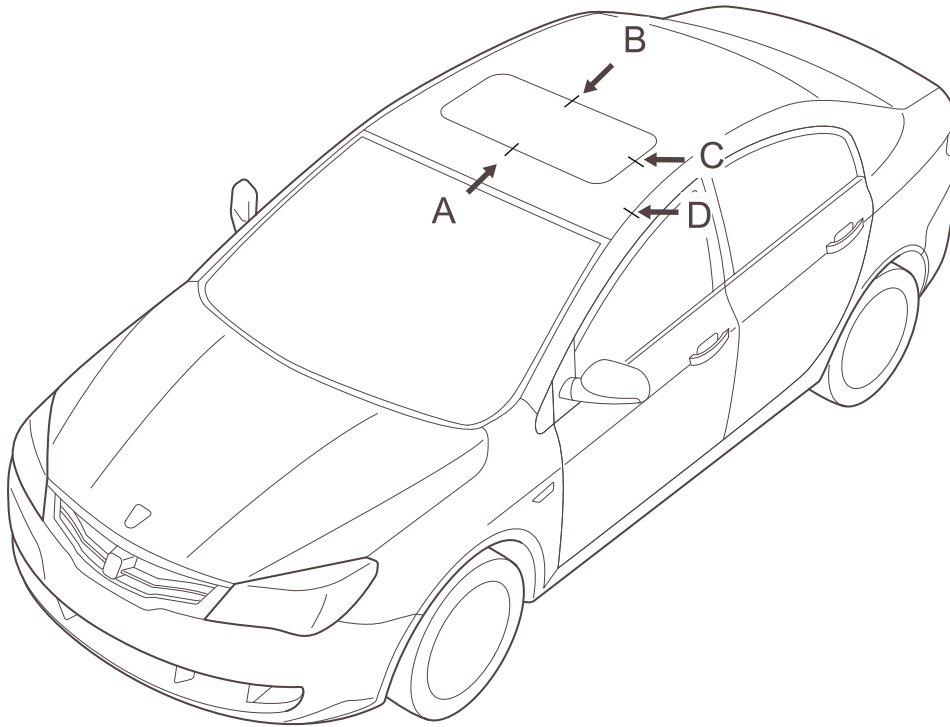


S882005

Gap

| Area | Gap (mm) | Outer Profile (mm) |
|------|----------|--------------------|
| A | 2.8±0.8 | 0.5±0.5 |
| B | 2.8±0.8 | 0.5±0.5 |
| C | 2.8±0.8 | 0.5±0.5 |
| D | 2.8±0.8 | 0.5±0.5 |

Sunroof Information



S882006

| Area | Detailed Description | Gap (mm) | Outer Profile (mm) |
|------|--------------------------|----------|--------------------|
| A | Roof to Sunroof | 0 | 0+1 |
| B | Roof to Sunroof | 0 | 0-1 |
| C | Roof to Sunroof | 0 | 0±1.0 |
| D | Roof Garnish to Bodyside | 1.9±0.75 | -2.0±1 |

Paint and Coatings

General Description

Preparation for Paint

Painted Surface Refinishing

The following operation must be observed during painted surface refinishing:

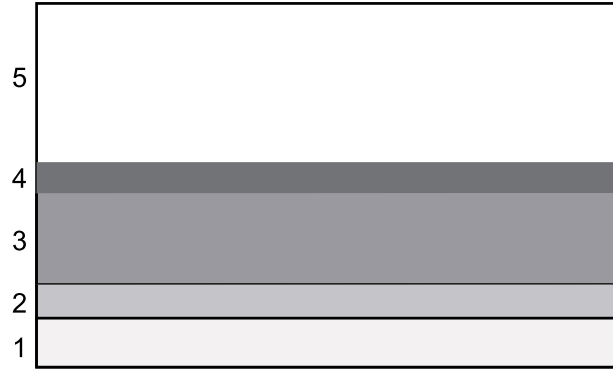
1. Seal the inner and outer seams with the qualified seam sealant.
 2. Refinish any damaged sealant area under the body.
- Corrosion Protection
3. Use the two-pack paint refinishing system, and keep it comport with the original production part.
 4. Apply the cavity wax to the inner surface where the paint repair is not performed.

Paint Repair

The following procedures must be observed when performing the paint repair:

1. The vehicle must be thoroughly washed using the steam washer or high pressure washer before performing the paint repair.
2. Use a mild water-mixable detergent to wash the local area need to be repaired, then clean it thoroughly with solvent. The paint operation must be performed immediately after this procedure.
3. In order to make sure that the metal exposed area caused by the damaged painted surface is cleaned thoroughly, the cleaned area is larger than the original damaged area.
4. The exposed metal is handled with the phosphate to remove any dust, etc., and the good repairing condition is provided for the new paint coat.
5. Re-treat the affected area using either a separate acid-etch primer and two-pack surfacer or an integrated etch primer/filler, and follow with a two-pack paint system.
6. When handling the unpainted surface, it is performed according to the paint operation with the qualified cavity wax.

Painted Surface Composition



S882044

1. Vehicle Body
2. Etch Primer
3. Repair Primer
4. Colored Paint
5. Clear Coat

Caution: When baking finished paint coat, the heating temperature must not exceed the panel temperature of 60 °C (140 °F) and the maximum heating cycle must not exceed 30-40 minutes. If the values of the temperature and cycle exceed these figures, damage to the vehicle electrical system and deformation to the plastic parts will be resulted.

Paint Working Operation System

The following operation must be observed during painted surface refinishing:

- Peel off the used paint and refinish the panel surface;
- Level up the panel and refinish the panel surface again;
- Paint the local again;
- Level up finely and polish;
- Local polish;
- Whisk with the duster;

The "local" here means that the upper limit of the paint repair area is approximately 380 mm × 380 mm, and the area is a part of entire panel.

There is an inspection list which is used to help contrast paint work in this section. The list is divided into 3 main service types:

1. Repairs to panels with scratches down to bare metal
2. Refinishing new original replacement panels
3. Refinishing painted panels that are original equipment or two-component material

The above classifications are for reference only.

When using the product from the designated paint manufacturer, the paint repair procedures are made according to the explanation and suggestion.

Repairs to panels with scratches down to bare metal

- Degrease on the panel or area to be repaired;
- Polish the damaged area with the dry-type P240 sandpaper - wet-type P400 sandpaper, and thin the edges around the paint.
- Polish the entire panel;
- For polishing the entire panel: if the primer is sprayed to the entire panel, use the dry-type P240 sandpaper;
- For spot repair: polish with the polishing block covered with the dry-type P400 sandpaper or the wet-type P800 sandpaper; lastly, polish manually with the wet-type P1000 sandpaper;
- Clean and degrease the panel with the air gun;
- If the exposed metal is visible, apply a Wash Etch type primer with a thickness of at least 25-30 mm;
- DO NOT grind off the Wash Etch type primer; apply the two-pack colored paint to the recommended thickness (the color of the colored paint should be the same as the original seal paint);
- To help polish with the sandpaper, use the deep color paint (DO NOT use the black cellulose gasoloid). Use the mixed primer or dry power type primer;
- Polish with the dry-type P500 sandpaper or wet-type P1000 sandpaper. (The thickness of the two-pack primer is at least 80 mm);
- Remove any dirt and oil on the painted surface with the air gun;
- Apply the base coat to achieve opacity.
- After the primer solvent dries, the thickness of the applied clear coat is at least 45 - 50 mm;

Refinishing new original replacement panels

- Degrease on the panel or area to be repaired;
- Polish the entire panel with the dry-type P240 sandpaper;
- Clean and degrease the panel with the air gun;
- If the exposed metal is visible, apply a Wash Etch type primer with a thickness of at least 25-30 mm;
- DO NOT grind off the Wash Etch type primer; apply the two-pack colored paint to the recommended thickness (the color of the colored paint should be the same as the original seal paint);
- To help polish with the sandpaper, use the deep color paint (DO NOT use the black cellulose gasoloid). Use the mixed primer or dry power type primer;

- Polish with the dry-type P500 sandpaper or wet-type P1000 sandpaper. (The thickness of the two-pack primer is at least 80 mm);
- Remove any dirt and oil on the painted surface with the air gun;
- Apply the base coat to achieve opacity.
- After the primer solvent dries, the thickness of the applied clear coat is at least 45 - 50 mm;

Refinishing painted panels that are original equipment or two-component material

- Degrease on the panel or area to be repaired;
- Polish the entire panel with the dry-type P240 sandpaper or the polishing block covered with the wet-type P800 sandpaper. To achieve the optimal effect, lastly, polish manually with the wet-type P1000 sandpaper;
- Clean and degrease the panel surface with the air gun;
- Apply the base coat to achieve opacity.
- After the primer solvent dries, the thickness of the applied clear coat is at least 45 - 50 mm; Hint: The above are for reference only. The product explanation and suggestion from the designated paint manufacture is the standard when using it practically.

Collision Repair

Description and Operation

General Welding Protection Measure

General

For easy reference, only the welding type for service which is different from the welding type for production is displayed only in the component layouts of the following pages.

The stand-by welding methods in the welding component layout are expressed with the following symbols:



S883029

A. = Plug Welding for Single Thickness/Variou Thicknesses

B. = MIG Seam Welding

When performing the welding operation, observe the following standards:

- If the resistance spot welding has been used in the production process, the new resistance spot welding must be performed at other possible positions. The interval must be 30 mm among all this kind of new-generated spot welding.
- When the spot welding is performed, it is suggested that the testing coupon of the same metal gauge and material is made for performing the peeling test to make sure that the welding equipment in use joints the seam accurately. If the performed spot welding is not as specified, the plug welding must be performed.
- The length of the welding handle on the hand-hold spot welding gun should not exceed 300 mm.
- The spot welding on single side is prohibited;
- The brazing and gas welding are prohibited unless being specified in the production.
- When welding the metals with 3 or more different thicknesses, the MIG plug welding should be used to ensure the strength of the seam.
- When the seam cannot be repaired using the resistance spot welder, use the MIG plug welding. To change each production spot welding, a hole about 8 mm long should

be drilled and/or punched, then perform the MIG plug welding on this position. The number of the plug welding should be the same as the number of the removed spot welding.

- After removing the spot welding, holes will be left on the panel, the single thickness MIG plug welding should be performed properly at each hole.

Electronic Control Unit

Before performing the welding repair operation, the following protection measures should be properly performed in consideration of the electronic control unit (ECU) fitted on the vehicle. A lot of heat and excessive vibration are generated during these operations, the electronic control unit may be damaged.

When disconnecting or removing the airbag diagnosis control unit (DCU), strictly observe the following suitable protection measures.

Protection Measure of Supplemental Restraint System

When performing all operations related to the removal or replacement of the supplemental restraint system (SRS), take extra care and observe the suitable protection measures.

Equipment

When performing any test on the vehicle, make sure that the related testing equipments operate normally and all wire harnesses and connectors are in good condition. This is especially important to the electronic control unit.

Seat Belt Riveting Point

The key of the safety is the seat belt riveting point. When repairing these areas, observe the following design specification is very important. Notice: The high strength low alloy (HSLA) steel may be used at the mounting position of the seat belt.

Use the original produced assembly including the seat belt riveting point as much as possible, or prevent the secant location from interfering with the original seat belt riveting point.

Be careful to inspect the welding quality of the seat belt riveting point welding seam within 250 mm, including the spot welding interval.

Anti-corrosion

Handling Way in Production

During production, the vehicle body should be handled using the following anti-corrosion material:

- The underbody sealant taking Polyvinyl Chloride (PVC) as the basic: painted at the underbody of the main floor and rear floor; and rear wheel opening;
- Cavity wax: painted at the panel such as sill panels, side member extensions and the lower areas of the door panels;
- Protecting wax: painted at the wheel opening which is not covered by wheel house.

Whenever repairing the body, always make sure to repair or renew the anti-corrosion material of the body area which need to be repaired. Make sure that the used material is approved as anti-corrosion material.

Precaution of Repair and Operation for the Body

In the workshop, always be careful when operating the vehicle. For instance, when raising the vehicle, if careless, damages to the sealant and welding seam seal material on the underbody, underbody seal wax and body panel etc. may be resulted.

Anti-corrosion Method for the Vehicle Owner

Except the anti-corrosion method for the vehicle used in production, any other anti-corrosion method used personally could cause invalidation of "anti-corrosion protection" items, so it is not recommended. But the approved, general protecting wax can be applied to the present coat of the body.

Assemble the Approved Fittings

When assembling the fittings, make sure that the anti-corrosion protection is not damaged due to the protection coat cracked or is affected with damp.

DO NOT fit the self-tapping screw into body panel directly. Secure the matched plastic inserted piece to the body panel in advance. Always make sure to apply proper zinc rich primer or acid-etch primer to the edge of the drills on the panel, the components of the chassis and other vehicle body components, and apply a coat of protecting wax on the surrounding area.

DO NOT touch the vehicle body with the fittings painted metal surface directly under the situation that no proper protection is performed. Make sure that there is proper medium (such as weldable zinc rich primer or zinc strap etc.) between the metal surfaces connected with bolts.

Steam Cleaning and Dewaxing

As the high temperature produced by steam cleaning equipment may cause the risk of damaging some decoration parts, softening or liquefying some of the bond and

anti-corrosion protection material, adjust the equipment to make the temperature of the nozzle no more than 90°C (194°F). And be careful not to leave the steam nozzle in a place for a long time, keep the distance between the nozzle and the panel surface at least 300 mm.

During repairing, never remove the protection wax or paint on the underbody or under the bonnet. If these areas must be cleaned with steam, apply a coat of new protection wax or underbody protection coat as soon as possible.

Inspection During Maintenance Service

When checking the body for anti-corrosion, observe the following procedures:

- Raise the vehicle, and check the damage condition of the underbody sealant visually;
- Lower the vehicle, and check the damage condition of the painting surface outside the vehicle body and the corrosion condition of the vehicle body panel.

Note: If the vehicle to be checked is dirty, always clean the vehicle prior to inspect the vehicle body.

The inspection above only refers to check visually. When the inspector check the vehicle for corrosion and damage condition of the paint, removing all kinds of trim panels or quieter material is not necessary.

1. After raising the vehicle, using testing light or spotlight, the inspector could check the following conditions visually:
 - The corrosion damage, the paint surface damage and sealant conditions of the front and rear lower panel, the rocker and the underbody wheel opening;
 - The damage condition of underbody sealant. Corrosion conditions in the areas around the suspension mounting point and the fuel tank mounting point.

Note: When the metal are not exposed, the vesicle on the sealing material of the underbody can be neglected.

In particular, pay attention to the signs of damage on the panel or anti-corrosion protection material due to the incorrect raising method.

Warning: The correct raising and lifting procedures must be followed.

2. After lowering the vehicle, check all the visible painted surfaces for signs of damage or corrosion visually, and pay especial attention to the following areas:
 - Bonnet Front Edge
 - Visible Bead of Engine Bay
 - Lower Body and Door Panel

All signs of body damage or corrosion found during inspection should be corrected and repaired with enforceable method as soon as possible. It includes reducing the extending of damage area and make sure that the anti-corrosion handling when producing is effective for a long time. If the corroded area is gradually clear and expands from the bottom of replaceable parts (such as each kind of garnish, window glass, seat etc.), this part needs to be replaced to achieve the best repairing effect.

Underbody Protective Repair

Whenever repairing the vehicle body, make sure that the body seal and anti-corrosion protection measures renew completely. This is not only for repairing the damaged area, but also for servicing the protection coat in some areas weakened indirectly due to the accident or repair operation.

Before correcting or repairing panel, the anti-corrosion protection coat of the damaged area must be removed. It is particularly important for the panel with protection wax, the underbody with polyvinyl chloride (PVC) seal material and acoustic board area etc.

Warning: Never use oxy-acetylene equipment to remove corrosion protection materials. A large amount of smoke and gas will be released by these materials when they are burning.

Note: The device used for removing strong anti-corrosion sealant can provide many speed rate and efficiency. The scraper (not air chisel) driven by compressed air using the mighty fast reciprocating movement provide a relatively quiet mechanism way. Move the tool operation edge along the work piece surface to remove the seal material.

The most common removing way is that operating with the hot air blower which integrated with scraper. One of the most effective methods is that operating with a "heat reamer" which has the character of fast cutting. This kind of tool utilizing a wide razor blade can conveniently enter some outer profile area which is difficult to reach with other ways.

When repairing the vehicle body priming coat, adopt the following procedures:

1. Remove the present vehicle body priming coat;
2. After repairing the panel, wipe the affected area with solvent and handle the exposed metal with etch phosphate material;
3. Reapply the primer to the affected area;

Caution: Never apply the priming coat directly to the exposed metal surface under any circumstances.

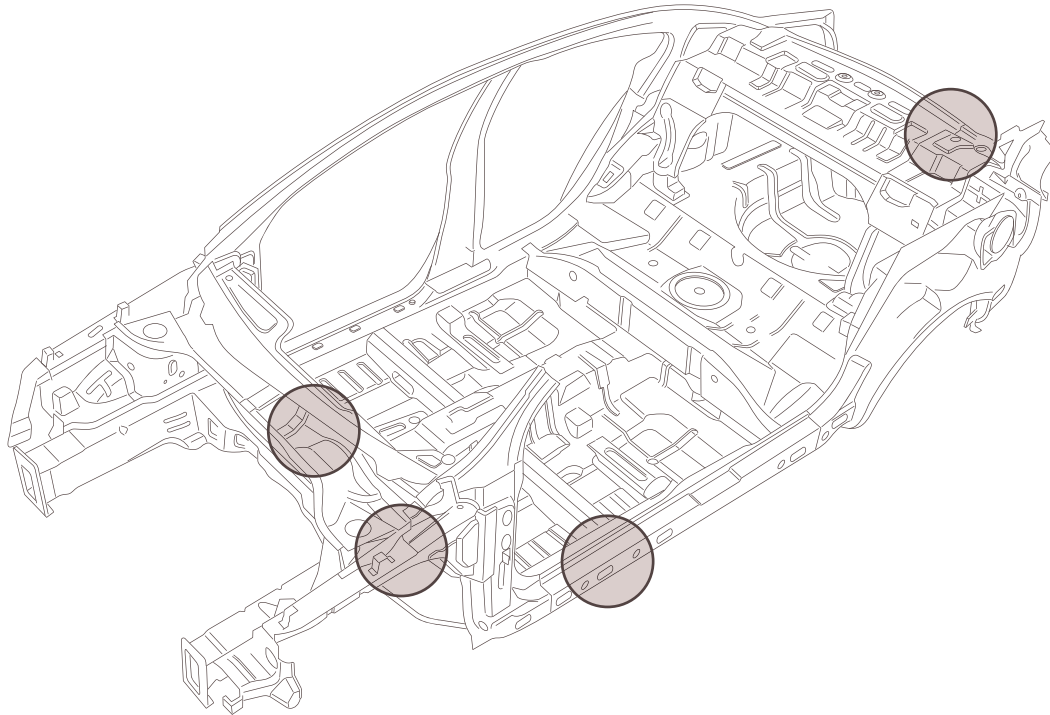
4. Replace all the damaged heat-fusible plugs. If this kind of plugs DO NOT use the matching size rubber rings, make sure that the plugs are implanted to sealant;

5. After removing various mechanism parts, hoses and snap fits on the underbody, cover all the fitting surfaces. Underbody sealant must be applied completely before refitting the parts above;
6. Apply sealant to all the exposed seam;
7. Apply the approved underbody repairing sealant to the affected area;
8. Remove the coating on the fitting surface of each part.

After various mechanical parts including hoses, lines and other fixing parts are refitted, cover the brake disc and apply a coat of approved underbody protection wax.

Note: During repairing, for the certain area both need applying underbody protection wax and finishing coat, always apply paint first and then apply protection wax.

Perfusion of Cavity Wax



S882029

After repair is finished, always handle with the approved cavity wax. In addition, for all the inner surfaces which are damaged when repair, no matter whether they are handled or not during production process, handled with cavity wax is necessary. Among of them include all the cavities and inner of the doors. If necessary, other drills are allowed for easy to perfuse wax, but no drill should locate on the bearing parts. Make sure that all these drills handled with zinc rich primer properly and apply protection wax, finally seal with rubber ring.

Before perfusing wax, make sure that the cavity to be handled is free from contaminant and foreign objects. If necessary, clean the fragment inside with compressed air.

Make sure to perfuse the cavity wax after finishing all the finishing coat operations and before refitting other parts.

During applying, make sure that the cavity wax covers all the beams and seams and distributed to all the repairing areas which are new and have panel.

Underbody Protection Wax

After repairing the panel at the damaged wheel opening, always reapply the protection wax. The protection wax is also suitable for various finishing coat and underbody sealant.

The range that the old underbody protection wax removed is at least 200 mm larger than that of the new applied underbody sealant.

It should be noticed that this procedure of handling the perfused wax is not involved when assembling the new panel and the whole body case. This operation is carried out after repair.

The effective cavity wax protection measures are extremely important. Always observe the following points:

- Always finish the resurfacing of all the paint before perfusing wax;
- If necessary, clean the body panel area and blow the cavity clean before operating;
- During perfusing wax and drying, the temperature must be kept at 18°C (64°F);
- Check the spraying mode of the perfusion device;
- Cover all the areas that need no protection wax, and the areas possibly are contaminated by applying the protection wax too much;
- In the condition that possibly are contaminated, remove the body devices, such as the seat belt retractor;

- Before handling the inner structure of the door, lifting up the door glass to the condition of fully closed is necessary;
- Before refitting each component, the body parts usually covered by the ornament should be handled by spraying wax;
- Check if the draining holes of the body and door have been cleaned after the protection wax is dry completely;
- Keep all the devices especially the protection wax nozzle clean and tidy.

Body Seal

Underbody Seal Application Area

Underfloor areas and sill outer panels need to be handled with plasticized PVC deck glue. This kind of glue is not suitable for reuse. When repairing the sealant of the underbody area, the deck glue applied at factory should be peeled off and restored to the proper breakpoint. Be sure to expose the clean metal surface and the current seal course edge also should stay on the panel firmly.

Use the new chassis glue between the primer and base coat. If necessary, use the seam sealant before applying the chassis glue. Before using the chassis glue, be sure to fit the choke plug and dead ring (except for those used for wax spraying) on the disc floor. Refit the heat-fusible plugs damaged during service with hot air blower or replace with rubber dead ring.

Caution: Ensure that suspension units, wheels, tyres, power unit, exhaust system and brake system (including all mounting points) are covered before the application of new vehicle body priming coat.

Seam Sealant

When assembling in factory, coat PVC sealant handled by thermocuring at the especial welding seam for connectors. This kind of material is not suitable for servicing, so use the seam sealant approved when servicing.

The seam sealant is used after spraying the primer and before spraying the base coat and the outer coat. The seam sealant should be sprayed continuously and smoothly, and the spraying line depends on the seam type. If the sealant is brushed, pay especial attention to keep the covering surface the seam should have. In the area that requires the sealant to be formed, cloth soaked with such as white spirit, can be used to complete the required operation.

After service at each time, be sure to seal all the seams need to be handled. When the vehicle is damaged, the area far from the collision point is usually twisted. As a result, during the next repair and correction, sealant in these areas may easily be contacted. Check all the seams around the repaired areas, check if there is damage, and then make a repair according to the requirement, and coat some new sealant. The procedures are as follows:

Clean the affected seams, and handle the exposed metal area again with the proper phosphorized primer:

Apply the proper sealant in the area needed:

Handling the affected area with acid-etch primer (as well as chassis glue) and coat appropriate colorized paint film.

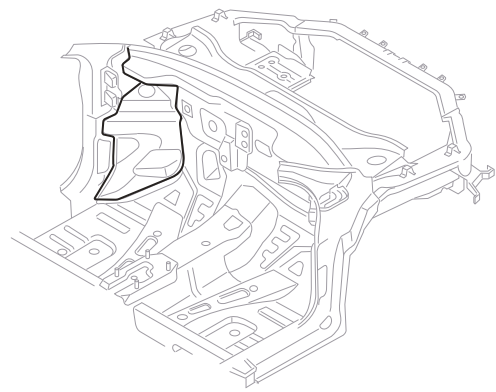
If the seams are blocked, coat ointment seam sealant to them when reassembly or components fitting is completed. After the panel is repaired, welding seam blocked may also occur. In

this case, coat some sealant and spray paint before the final assembly. If the size of entrance is appropriate, coat the seam sealant on both sides of repaired joint. If only one side can be coated with paint (such as the cabin), handle the affected cabin beam with cavity wax.

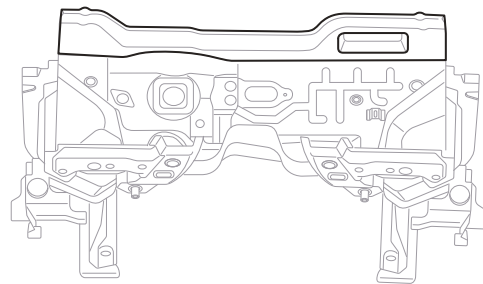
Seams coated with sealant when assembled at factory are described in the following chart.

Note: Thoroughly inspect all the joints near the repaired area. If necessary, seal all areas that have been jointed, repaired or replaced. Keep these areas from wetting or contamination. Sealing will help avoid: wetting and wind noise, etc. Always carry out a check on all the sealed areas before final quality inspection.

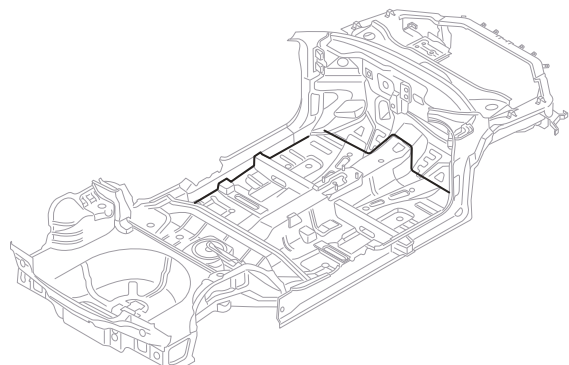
Spot Welding Sealant Application Area



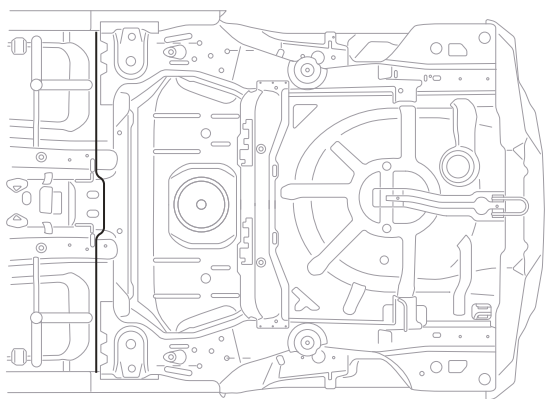
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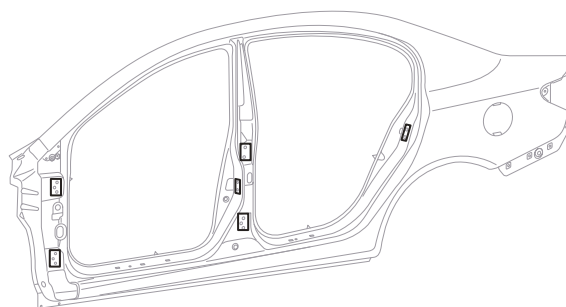
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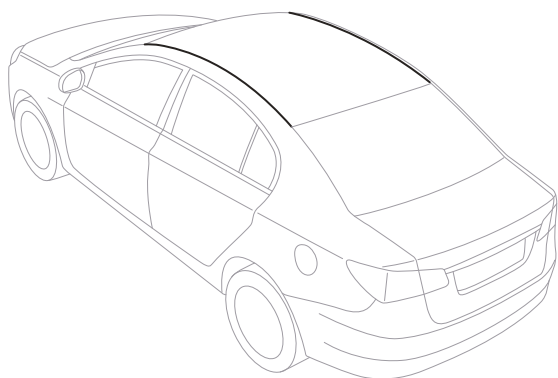
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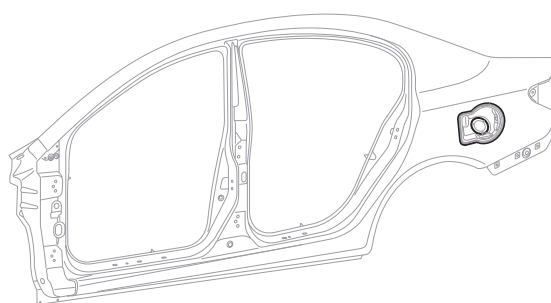
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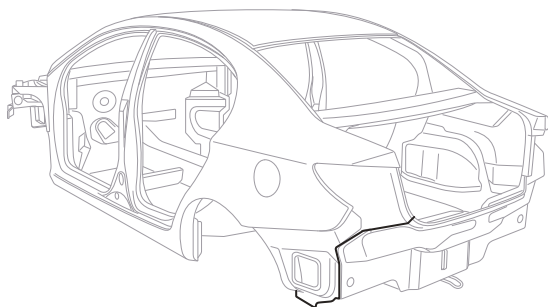
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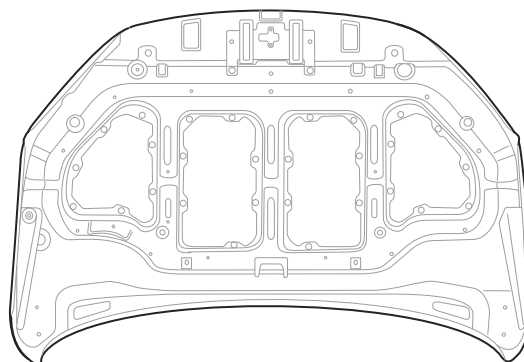
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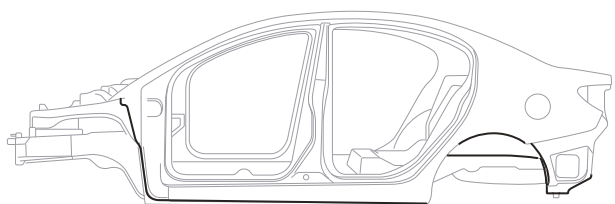
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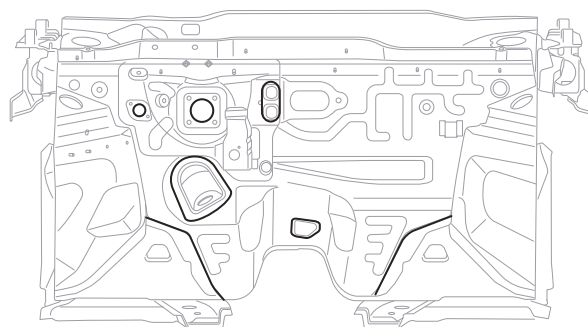
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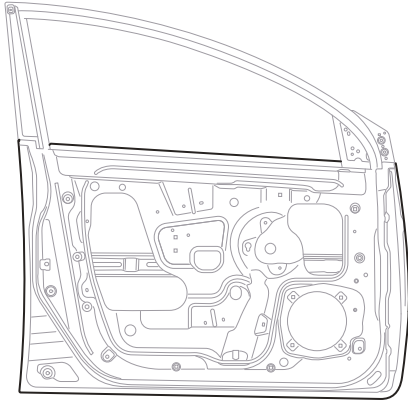
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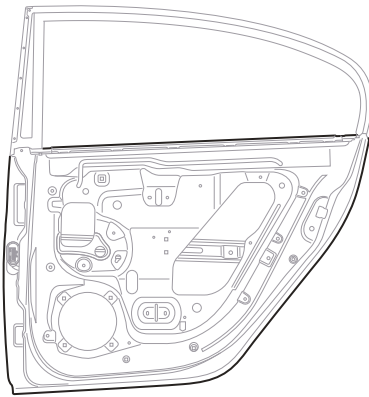


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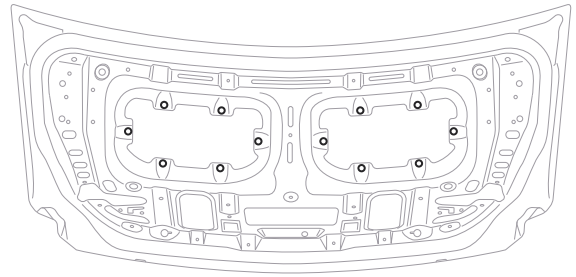
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Folded Seams Sealer Application Area

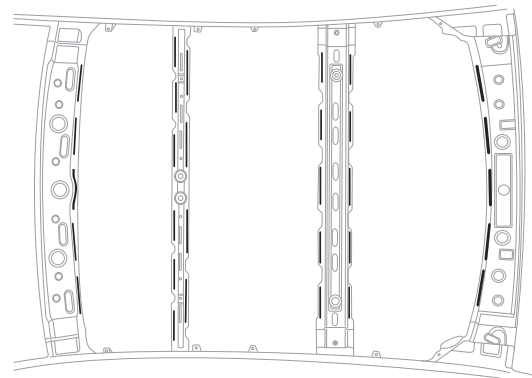


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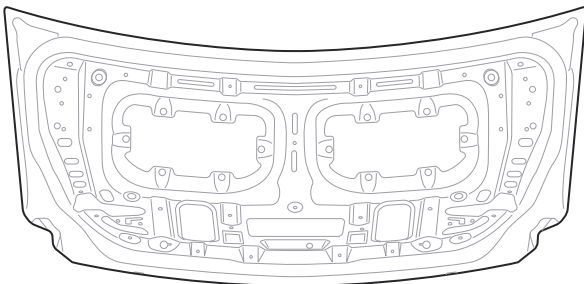
Damping Cushion Application Area



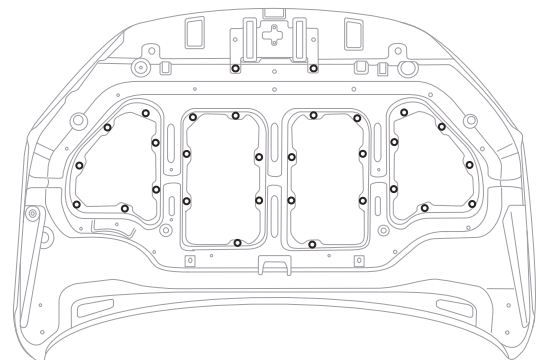
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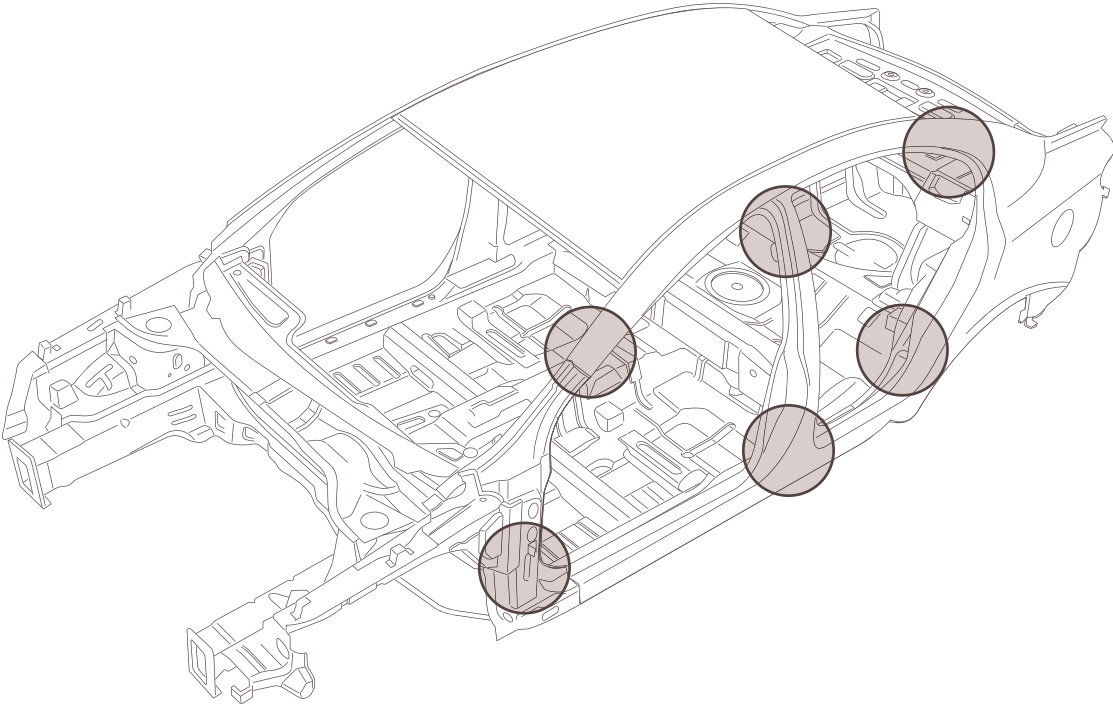


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Expansion Application Area



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Diagnostic

Water Leakage Test

General Description

For treating with the water leakage problem, you should combine the skill, experience and intuition to adopt a rational and effective measure. DO NOT come to a conclusion simply based on what have seen. For example, if the pedal is wet, you consider that it is caused by the water seeping through the windshield. Actually, the water leakage is often resulted by other reasons. No matter how difficult it seems like, as long as you operate following the correct test procedures, the water leakage area can be verified accurately.

Tools and Instruments

When detecting and correcting the water leakage problem, the following tools and instruments are recommended:

1. Garden sprayer (hand-operated)
2. Wet/dry vacuum cleaner
3. Dry, absorbent cloths
4. Battery torch
5. Battery torch
6. Weatherstrip locating tool
7. Trim panel remover
8. Small wooden or plastic wedges
9. Dry compressed air supply
10. Hot air blower
11. Sealer applicators
12. Ultrasonic leak detector

When detecting the water leakage, at least the following three parts should be checked:

- Front Inner Space;
- Rear Seat Space
- Storage Tray or Boot

Test

The operator in the parts centre can judge where to begin water leakage test through the information provided by the customer. The next step after finding the leakage area is to find the leakage point.

In the first case, a convenient and effective way is to use the most common way, garden sprayer. Such extrusion type garden sprayer shall ensure the spray nozzle can be adjusted, so that the water can be sucked into the spray nozzle directly and spray out appropriate mist. At the dark corners, a mirror or a battery torch can be used (The testing lamp using the supply voltage cannot be used).

The order of the test is very important. The test starts from the lowest point and move gradually upward to avoid blocking the leaks in other areas when the test is performed in one area. If the test starts from the windshield, then all the water flowed into pressurized chamber may be possible drop upon the pedal through the partition dead ring. Even so, it may be incorrectly determined that the windshield sealing has problem.

Another important part when checking the water leakage is to observe if there is damage, deterioration or displacement to the door hole seal dead ring or weatherstrip. At the same time, align the door with the seal.

Note: Check the color of the water around the leakage. If the water is dirty, the leakage is at the bottom of the vehicle. If the water is clean, it is at the top. Once leakage is found at the seal, it is necessary to solve the water leakage using the following methods:

1. Replace all the damaged, displaced and deteriorated door hole seal and weatherstrip.
2. Check all the sealing strips on the vehicle body and make sure that they have been correctly positioned on the fixed flange/mounting surface. The curved knife can be used if necessary.
3. Dry the welded seams with compressed air and/or hot air blower where necessary.
4. If necessary, apply some sealant at the outside of the joints to prevent water.
5. When solving the water leakage of the windshield and its weatherstrip (or directly polish between the glass and the vehicle body), DO NOT remove the glass if possible. Use the qualified materials at the right place (for example, glass to weatherstrip or glass to the vehicle body).

Replace the Initial Sealing of the Door

The initial sealing of the front and rear doors are fixed in the correct position. Always observe the following precautions when replacing the sealing strips:

- Thoroughly clean the area to apply sealing strips. DO NOT clean the door with paint thinner.
- The ideal temperature to apply the sealing strips is 25°C (77°F). The sealing strips of the door or whatever cannot be applied well below 18°C (64°F).
- To ensure the sealing strips can be removed or refitted easily, the force applied to the sealing strips should not be too strong at the beginning. If the sealing strips need to be refitted, DO NOT touch the contact surface or contaminate it.

Service Procedures**Preparation for the Panel**

The offered new panel is coated with the cathodic primer, which not only can protect the panel itself, but also conforms to the regulation for vehicle anti-corrosion measures. **DO NOT** remove the primer before repairing the paint surface. If the panel has a partial damage or defect, make sure to remove as few as possible primer when repairing in order to ensure the repair result of high quality.

The damaged panel should be corrected by tapping or straightening if possible. When removing the corrosion on the outer surface or the spilled paint, polish the back coat in the affected area as needed, then operate according to the following procedures:

1. Clean the panel with the solvent.
2. Bonderize the exposed metal area.
3. Re-treat the affected area using either a separate acid-etch primer and two-pack surfacer or an integrated etch primer/filler.

Always observe the following operation when preparing the panel:

Welding Panel

Be sure to follow the procedures listed below when replace the welding sheet:

1. Remove the primer from the new welding panel, the edge connected with it and the area around, and clean these areas until the metallic luster exposed.
2. For the joint part preparing for spot welding, apply the weld-through zinc rich primer to both of the joint surfaces. Perform the spot welding when the primer is still wet or operate following the manufacturer's instruction.
3. Level up the welding bonding points that can be seen.
4. Clean the panel with the solvent.
5. Bonderize the exposed metal.
6. Rehandle the repaired area.

Panel

When partial panel needs to be replaced, the basic procedures are the same as the procedures for the above welding, but there are some changes as follows:

1. Remove the primer on the mating surface between the new and the existing panels, clean it until the metallic luster exposed.
2. Apply the weld-through zinc rich primer to the both mating surfaces on which the overlapped weld will be performed, and perform the spot welding when the primer is still wet or following the manufacturer's instruction.
3. The proper area can be welded in a manner of butting the joints using the MIG weld.
4. Grind out the joints to be welded.
5. Clean the panel with the solvent.
6. Bonderize the exposed metal.
7. Re-treat the affected area using either a separate acid-etch primer and two-pack surfacer or an integrated etch primer/filler.
8. Use the proper cavity wax to handle the inner surfaces of the joints which are overlapped or butted.

Bead Panel

When replacing the panel with a bead, always observe the following steps:

1. Polish the primer on the mating surfaces of the new and existing panels, and clean it with the solvent.
2. Apply metal binding agent to the proper area.
3. For the mating surfaces that need to be spot-welded, apply the proper weld-through zinc rich primer to them.
4. For the parts to be MIG/MAG welded or spot-welded, apply the zinc rich primer to the area close to the mating surfaces, but **DO NOT** handle the welding area.
5. When beading the edge of the panel, in order to maintain the complete of the panel at the bent mating surfaces, choose the spot welding or the plug welding properly as needed.
6. Clean the panel with the solvent.
7. Bonderize the exposed metal.
8. Re-treat the affected area using either a separate acid-etch primer and two-pack surfacer or an integrated etch primer/filler.

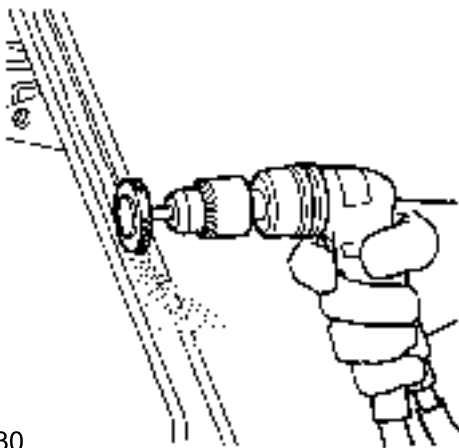
Panel Replacement Procedure

The procedure is designed to explain the methods to remove and replace the basic panel. The main standard for removing and replacing the body panel is to maintain the original standard if possible. Some special repairs have difference in detail. The procedure is designed to emphasize simplifying the repair and reduce the unnecessary work.

The body panel made of high-strength steel is increasing to meet the design requirement for safety and lightweight. Because the high-strength steel cannot be identified visually, and these panels are more sensitive to the excess heat than those made of low carbon steel. Always observe the following procedures.

Remove Panel

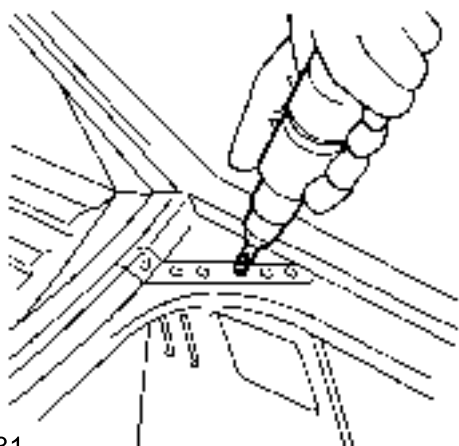
1. The resistance spot welding is exposed. As spot welding is not obvious, use a gyrate rolling drum abrader or wire brush fitted on pneumatic drill, or a hand-hold wire brush.



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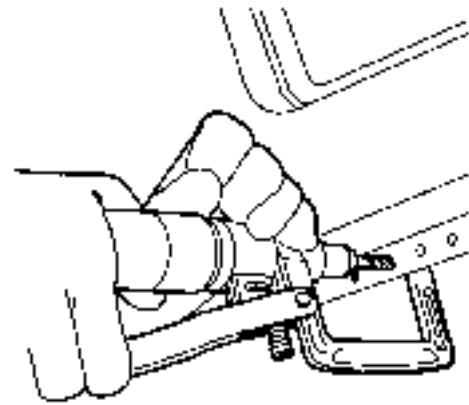
Caution: Before the spot welding is exposed, it is necessary to soften vehicle body priming coat using a hot air gun in wheel house area.

2. Cut the welding seam with cobalt drill.



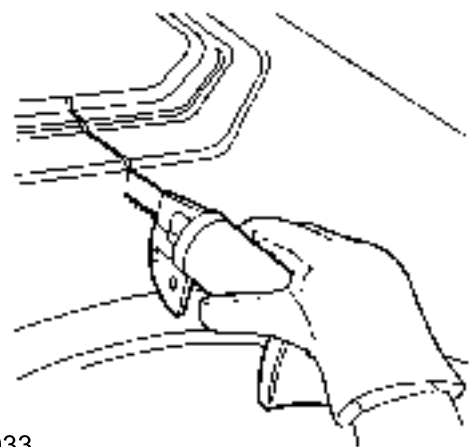
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3. A split-clamp type spot welding platoon welder can also be used.



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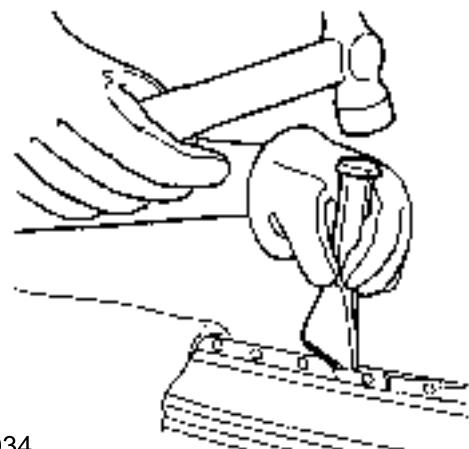
4. Cut the large panel with air saw if necessary.



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Caution: Before cutting off the large panel, the MIG welding seam and braze on certain panel joints should be removed using a sander.

5. Separate the electric welding joints and remove the panel remainders with a hammer, base-plate chipping chisel and plier.

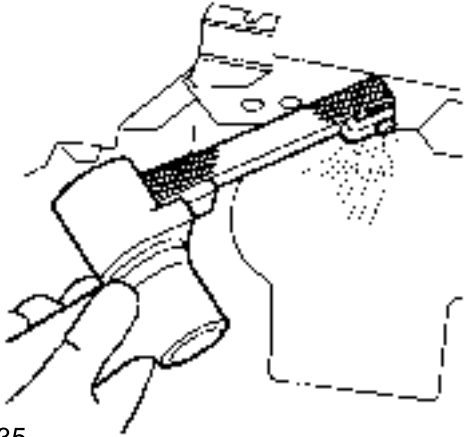


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Repair Old Surface

1. Using a hot air gun, remove all residual sealant to reduce the poisonous smoke due to the heat when welding.

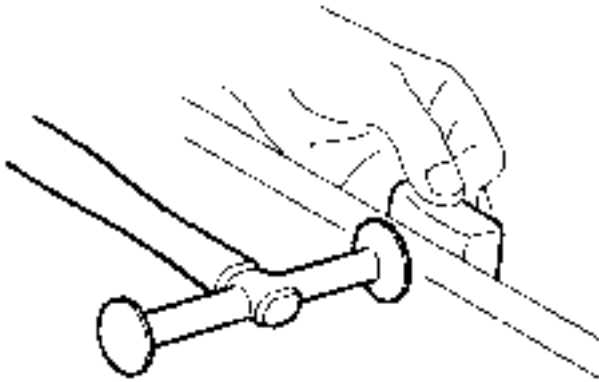
Warning: Care must be taken to avoid excessive heat build-up when using the hot air gun.



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2. Use the belt polishing machine to grind the edges of all the panel joints.

Note: The rotary sander also can be used.

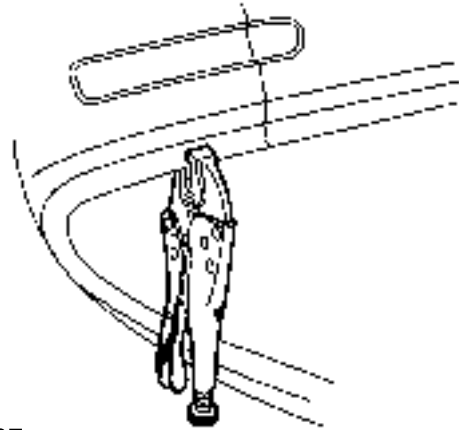


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3. Use a forming block and a hammer to straighten the jointing edge of the existing panel.

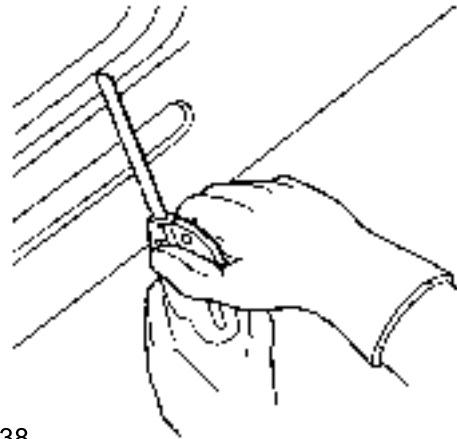
Repair New Surface

1. Line out the approximate shape of the new panel and repair it to the specification dimension, leaving the overlapping area about 50 mm for the existing panel. Provide new panel/section, align it with the related panel (for example, align the new bodyside panel with the door and the trunklid), and grip it to its place.



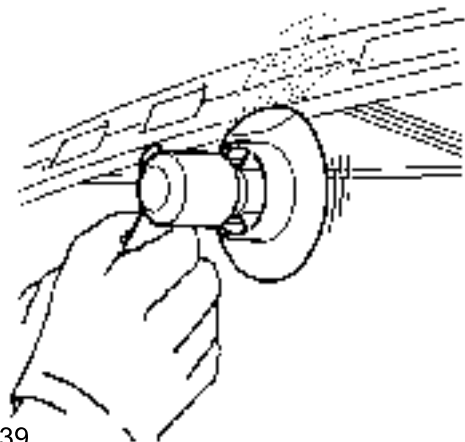
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2. If necessary, cut off the new panel and the existing panel so that the butted joint, joggling and brazing seam connectors can be formed. Take away all jigs and remove the residual metal material.



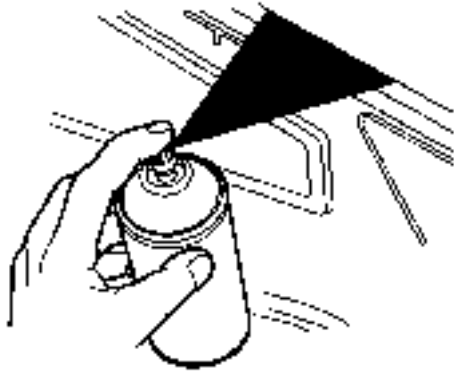
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3. Prepare new panel joint edges for welding by sanding to a bright finish. This must include inner as well as outer faces.



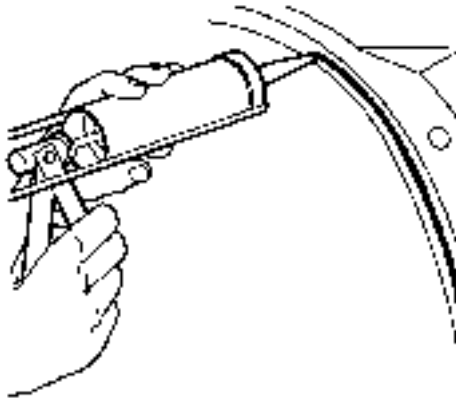
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4. Apply the appropriate weld-through primer to the mating surface of the panel with a brush or an aerosol can to prepare for welding.



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- If possible, apply the appropriate seal packing or binding agent to the mating surface of the panel.



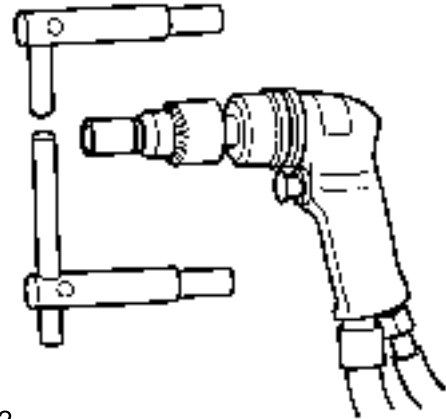
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Providing and Alignment

Provide a new panel and align it with the related panel. Using the electrode holder or mole clamp, grip it in place. At butted joint or braze joint, place a device near the joint edge of original panel or insert a span wire behind the seam.

Caution: When the access for electric welding pliers is difficult, it may be necessary to use the position welding.

- Select the electric welding arm used for the resistance spot welding and shape the electrode tip with the welding nozzle trimming machine. Trim the welding nozzle, make its diameter equals two times and 3.0 mm more than the welding metal thickness.

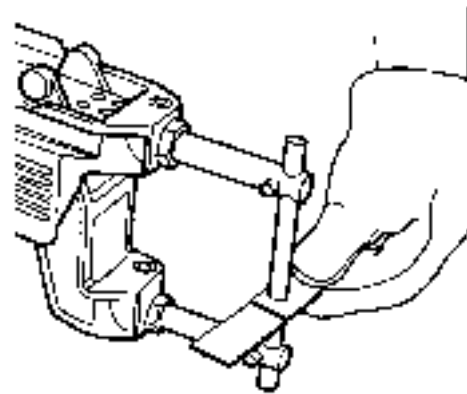


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Caution: Electric welding arms used should not exceed 300 mm in length.

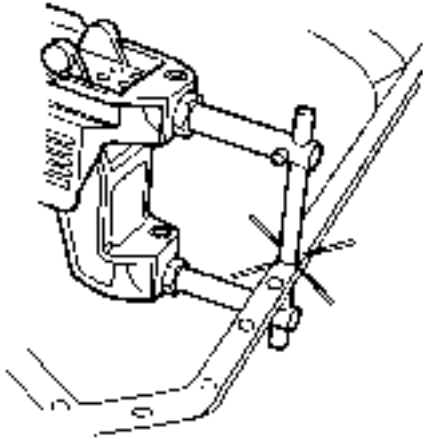
Note: To maintain welding efficiency, the welding nozzle requires regular cleaning and trimming.

- Use the test silicon chip to equip resistance spot welding arm and test equipment to meet the operation requirement. If there is no monitoring equipment, check the welding seam strength by checking the welding melting bath wire drawing separated around the metal in tension during extension.



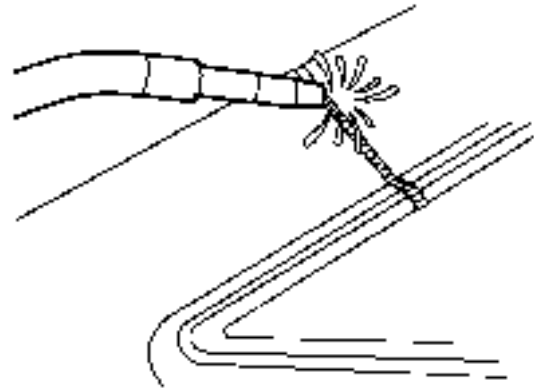
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- Resistance spot welding machine can also be used. Welding quality can be determined by using welding quality monitor if the condition is convenient.



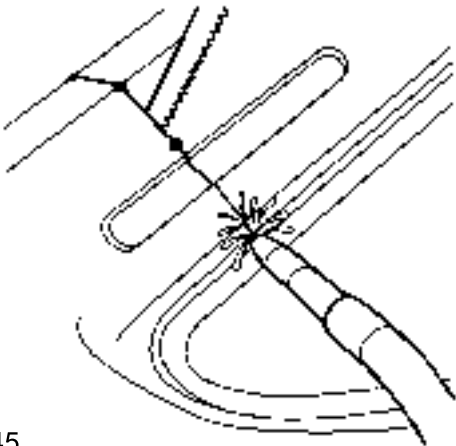
S883044

4. MIG position welding butted joint can be used when needed, recheck the alignment and panel profile. Insert a metal saw blade as a rough guide, leave a gap to reduce the welding deformation.



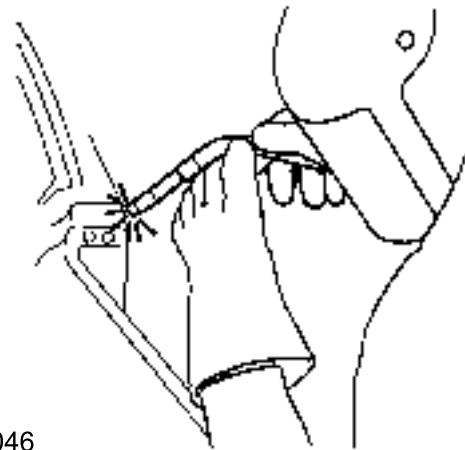
S883081

7. Always adopt MIG plug welding when metal is too thick or welding nozzle is near the limited area, and the resistance spot welding is unpractical. The hole left by spot welding cutter can be used in plug welding, as well as the specially punched or drilled holes (approximately 8 mm in diameter).



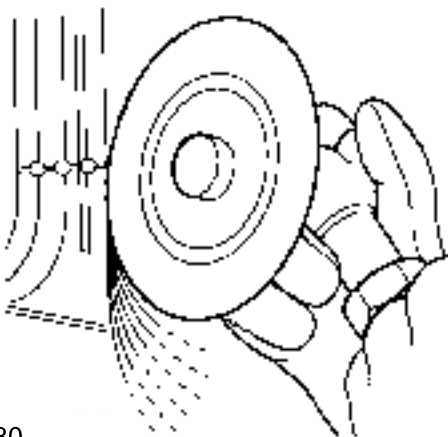
S883045

5. Trim MIG position welding with 36 abrasive disc polishing machine or belt grinder.



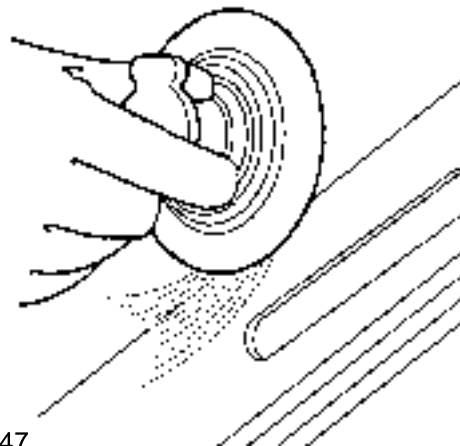
S883046

8. Trim all the welding with 36 abrasive disc polishing machine or belt grinder and/or wire brush. When trimming the welding, surface cleaning should be performed as less as possible to protect the zinc coating.



S883080

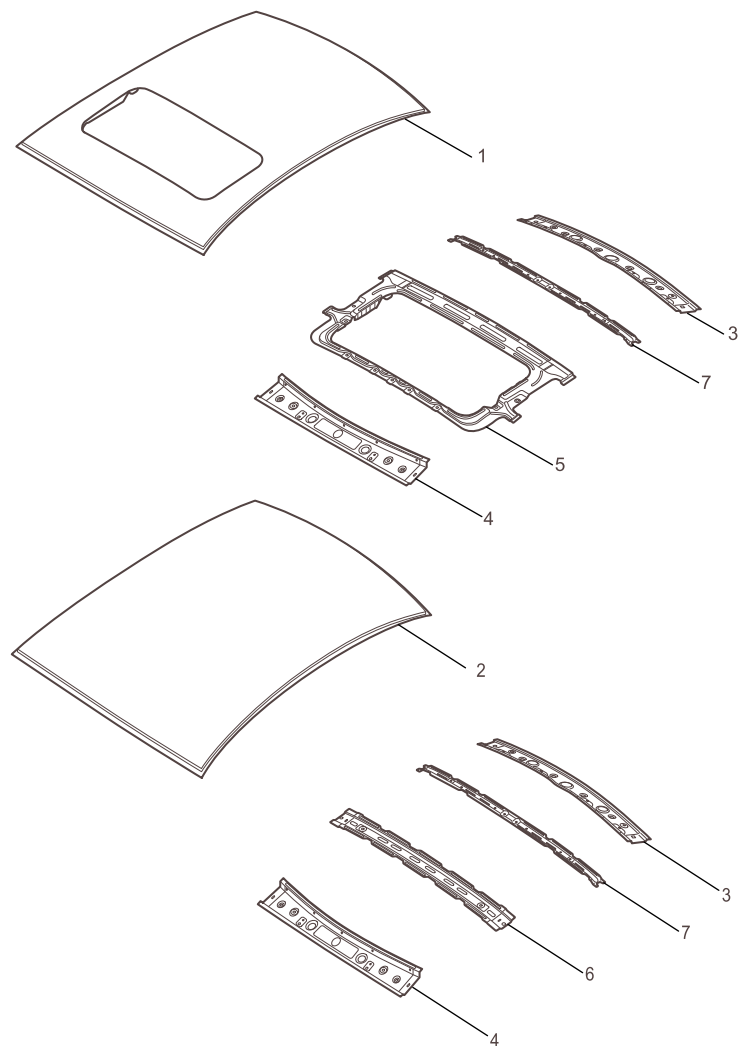
6. Weld the butted joint with MIG seam welding.



S883047

Service Panel Information

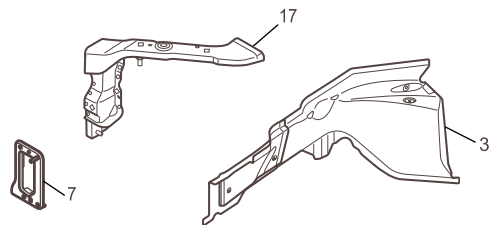
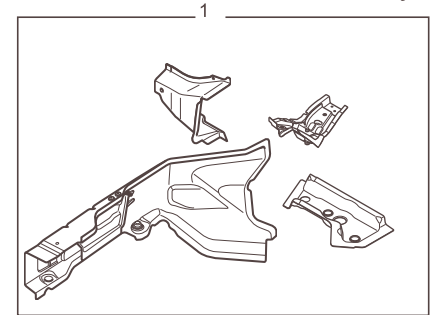
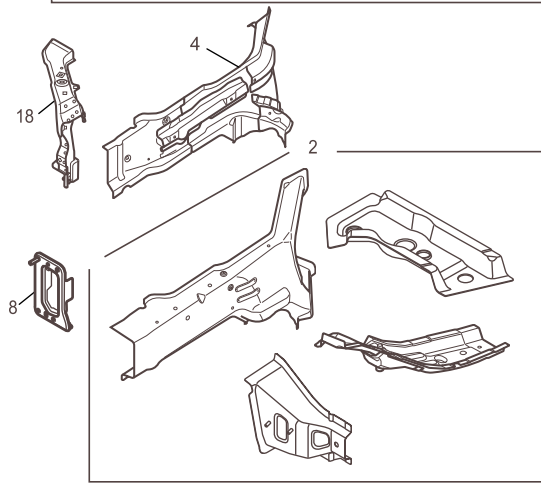
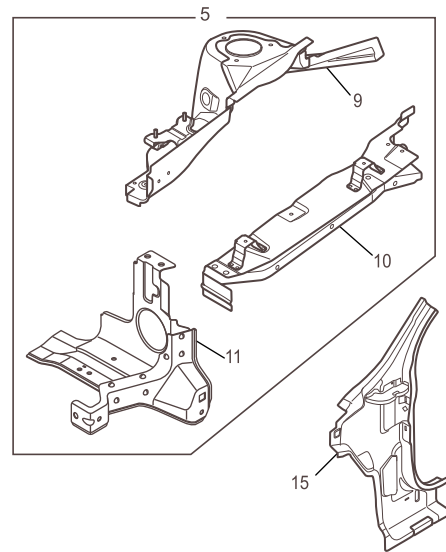
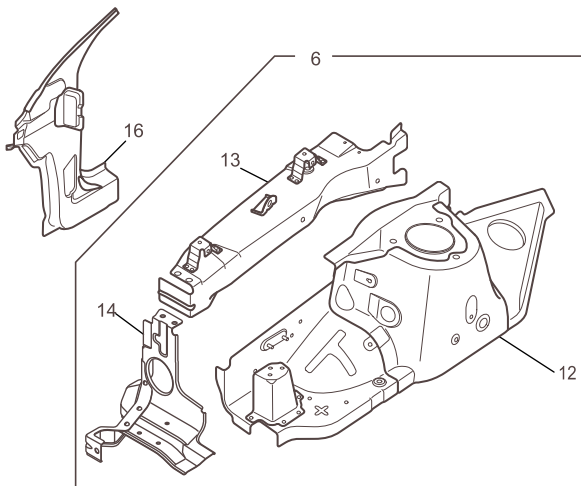
Roof Panel



S882019

1. Panel - Sunroof
2. Panel - No Sunroof
3. Rear Header Assembly
4. Rear Header Assembly
5. Sunroof Aperture Reinforcement Assembly
6. Center BOW NO1 Header
7. Center BOW NO2 Header

Engine Bay Plate

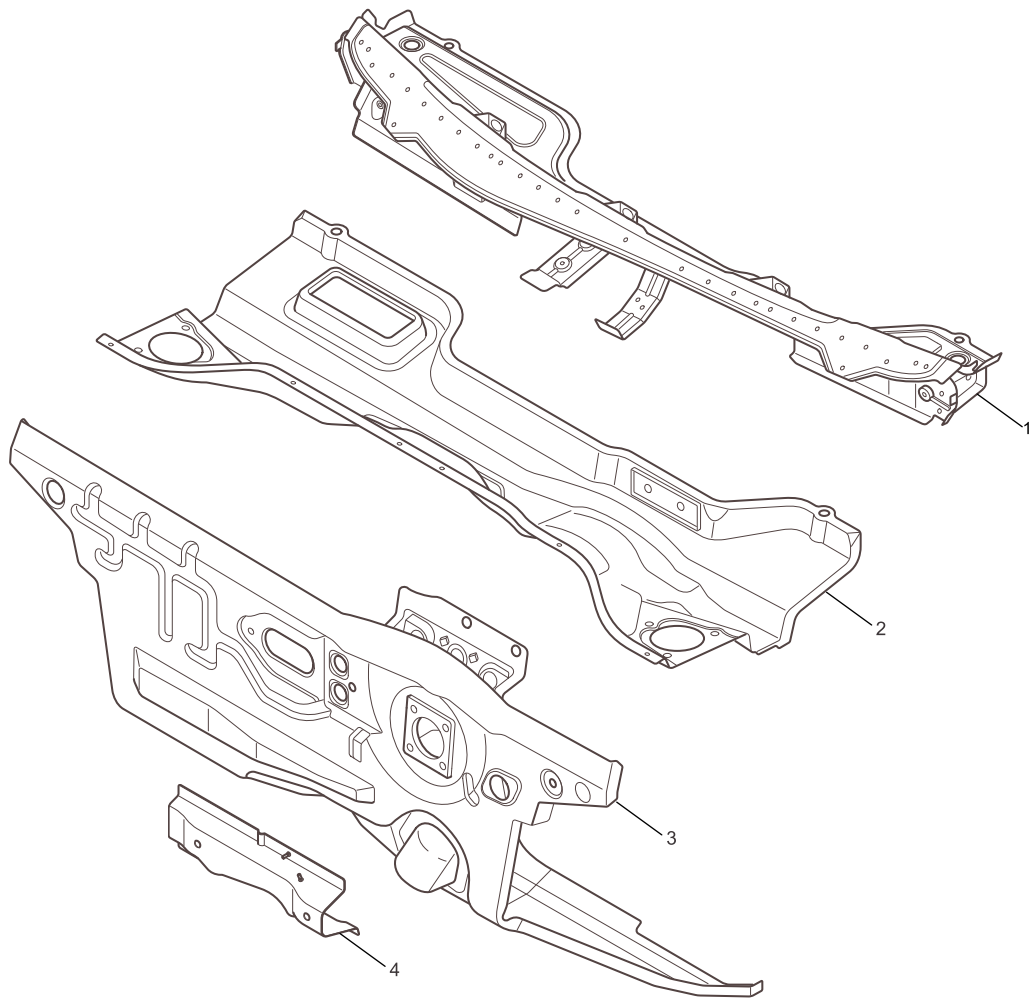


S882020

- 1. Front Longitudinal Member Inner Panel Assembly LH
- 2. Front Longitudinal Member Inner Panel Assembly RH
- 3. Front Longitudinal Member Outer Panel Assembly LH
- 4. Front Longitudinal Member Outer Panel Assembly RH
- 5. Front Wheel House Plate Assembly LH
- 6. Front Wheel House Plate Assembly RH
- 7. Front Bumper Mounting Bracket Assembly LH
- 8. Front Bumper Mounting Bracket Assembly RH
- 9. Front Wheel House Plate Sub-assembly LH
- 10. Front Wheel House Upper Longitudinal Member Assembly LH
- 11. Front Wheel House Front Extension Plate Assembly LH
- 12. Front Wheel House Plate Sub-assembly RH
- 13. Front Wheel House Upper Longitudinal Member Assembly RH
- 14. Front Wheel House Front Extension Plate Assembly RH

- 15. Front Bodyside Inner Reinforcement Assembly LH
- 16. Front Bodyside Inner Reinforcement Assembly RH
- 17. Headlight Mounting Frame Assembly LH
- 18. Headlight Mounting Frame Assembly RH

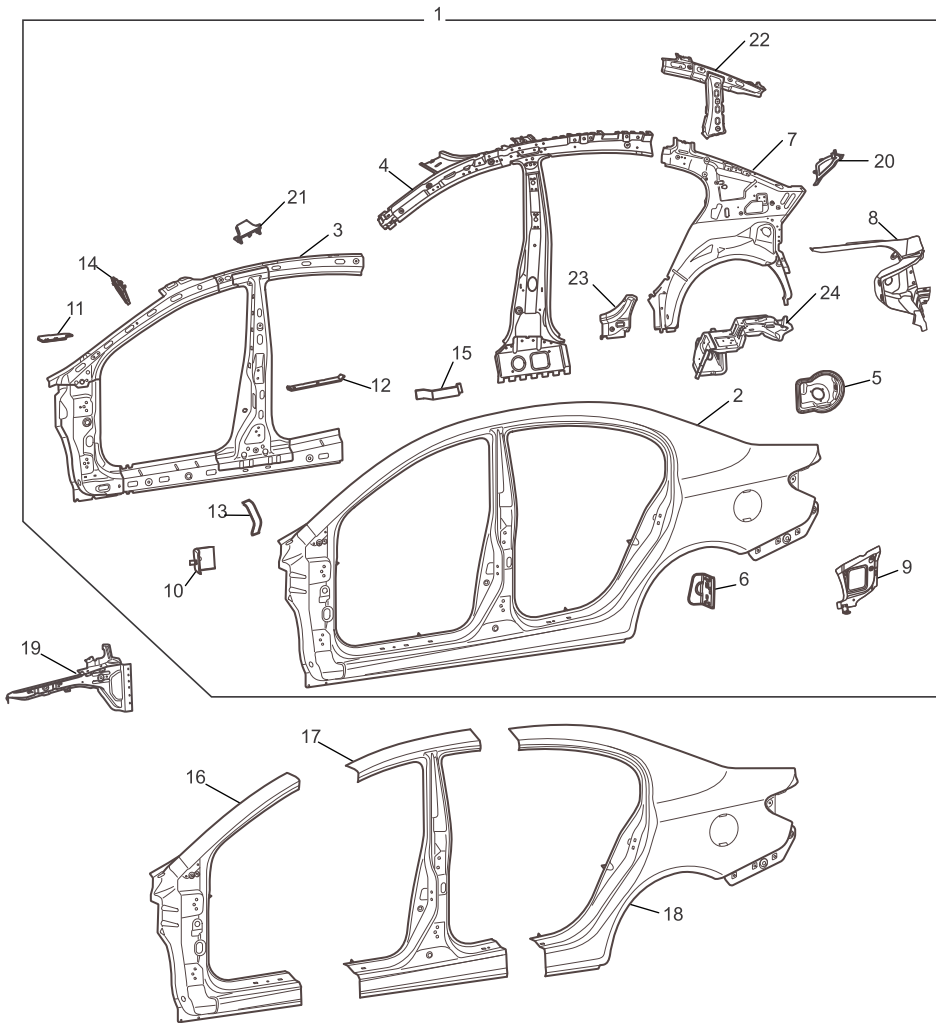
Dash Panel



S882021

1. Dash Panel Upper Panel Assembly
2. Plenum Assembly
3. Dash Panel Lower Panel Assembly
4. Dash Panel Crossmember Assembly

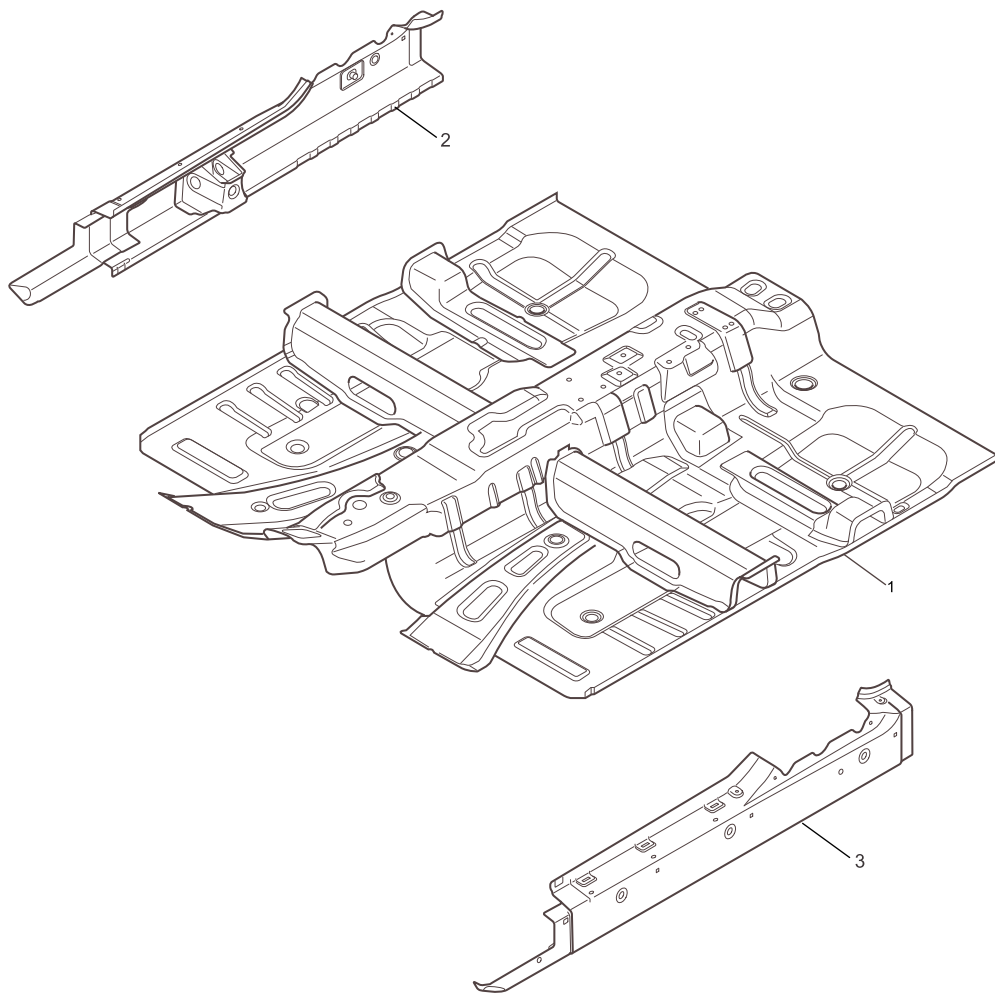
Body Side Panel



S882022

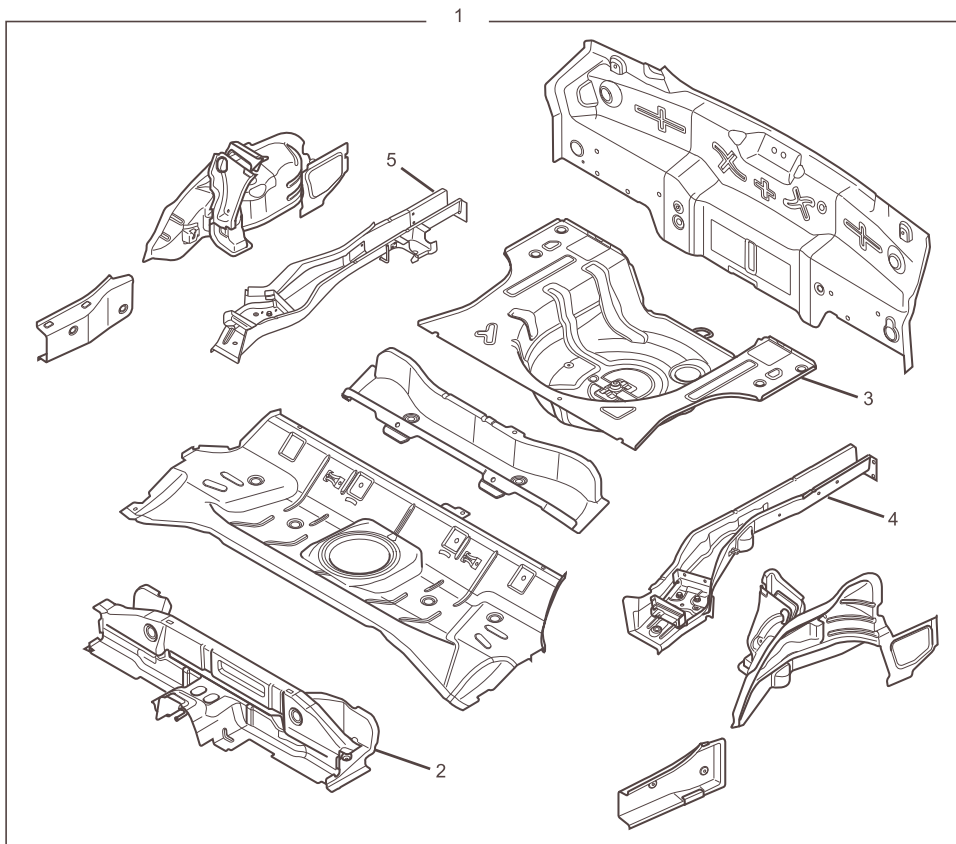
- | | |
|---|--|
| 1. Body Side Panel Assembly | 16. Front Body Side Outer Panel |
| 2. Body Side Outer Panel | 17. Centre Body Side Outer Panel |
| 3. Body Side Outer Panel Reinforcement Assembly | 18. Rear Body Side Outer Panel |
| 4. B Pillar Inner Panel Assembly | 19. Dash Panel Side Upper Crossmember Assembly |
| 5. Fuel Filler Door Mounting Assembly | 20. D Pillar Upper Inner Block |
| 6. D Pillar Striker Reinforcement Assembly | 21. BC Pillar Upper Block |
| 7. Rear Quarter and Rear Wheel House Welding Sub-assembly | 22. C Pillar Reinforcement Assembly |
| 8. Rear Light Mounting Bracket Assembly | 23. C Pillar Lower Reinforcement |
| 9. Rear Panel Lower Extension Plate Assembly | 24. Parcel Shelf Side Plate Rear Assembly |
| 10. Lower Fender Mounting Bracket Assembly | |
| 11. A Pillar Lower Block | |
| 12. BC Pillar Lower Inner Block | |
| 13. A Pillar Upper Outer Block | |
| 14. A Pillar Upper Inner Block | |
| 15. BC Pillar Lower Outer Block | |

Front Floor



S882023

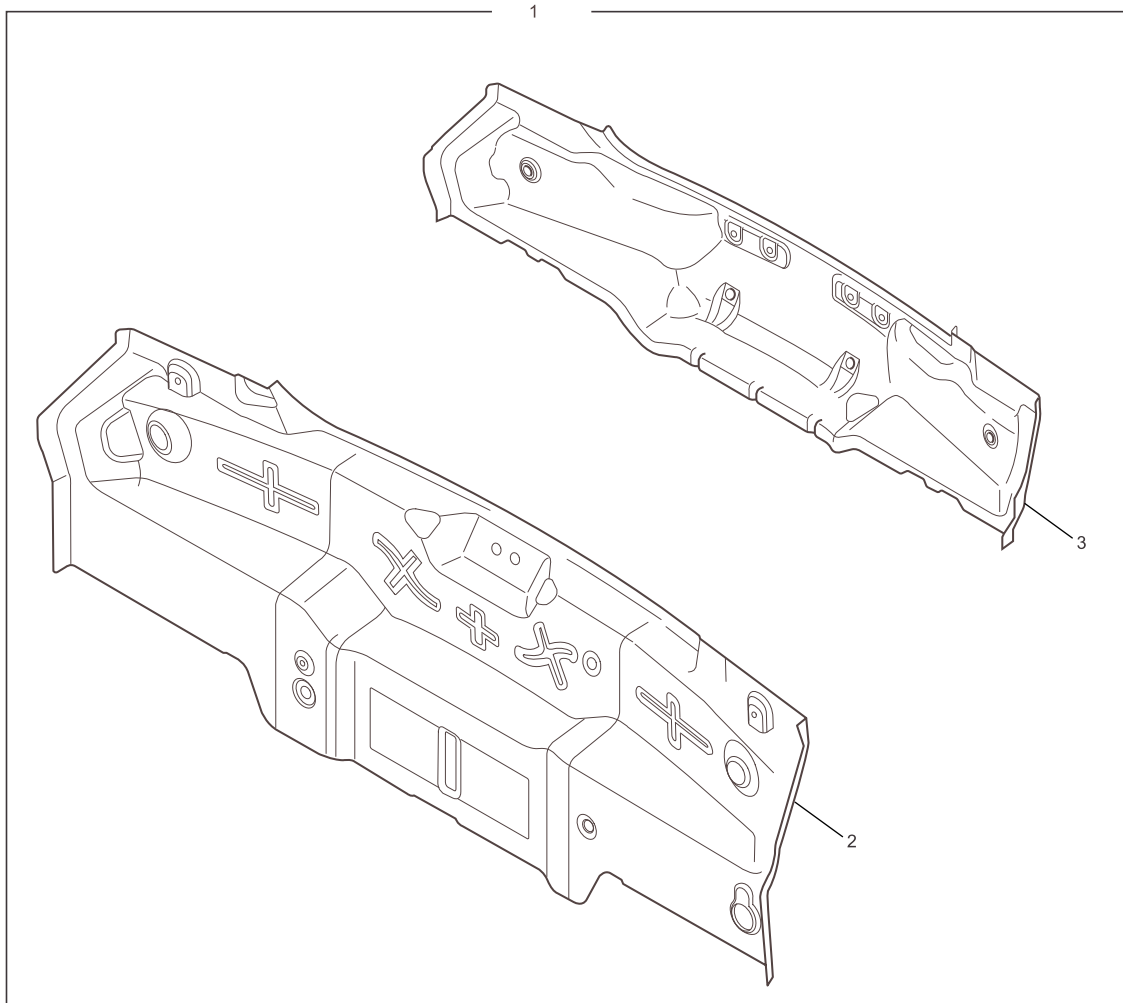
- 1. Front Floor Assembly
- 2. Inner Sill Assembly RH
- 3. Inner Sill Assembly LH

Rear Floor

S882024

1. Rear Floor Assembly
2. Rear Floor 1st Crossmember Assembly
3. Rear Floor Assembly
4. Rear Longitudinal Member Assembly LH
5. Rear Longitudinal Member Assembly RH

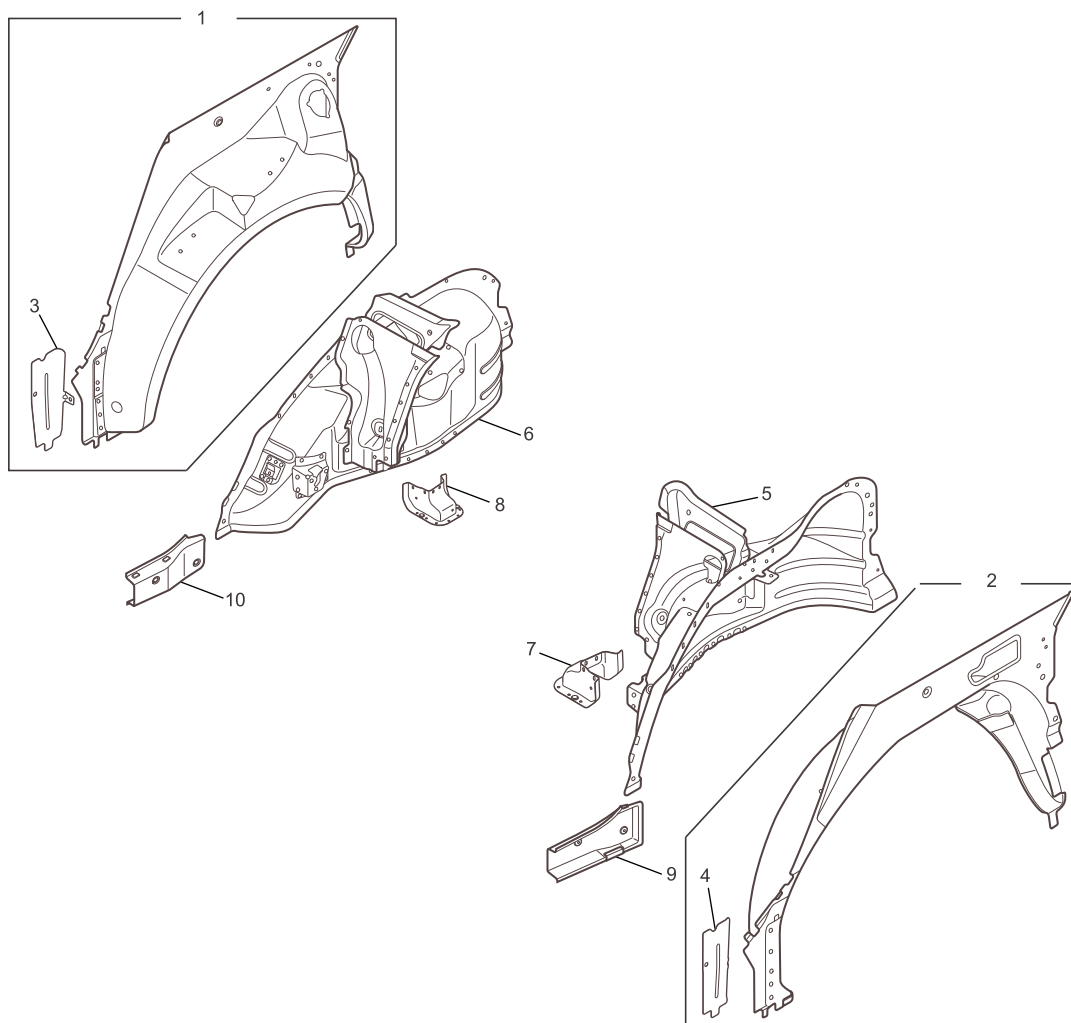
Rear Body



S882025

- 1. Rear End Panel Assembly
- 2. Lower SQUAB Assembly
- 3. Rear Body Assembly

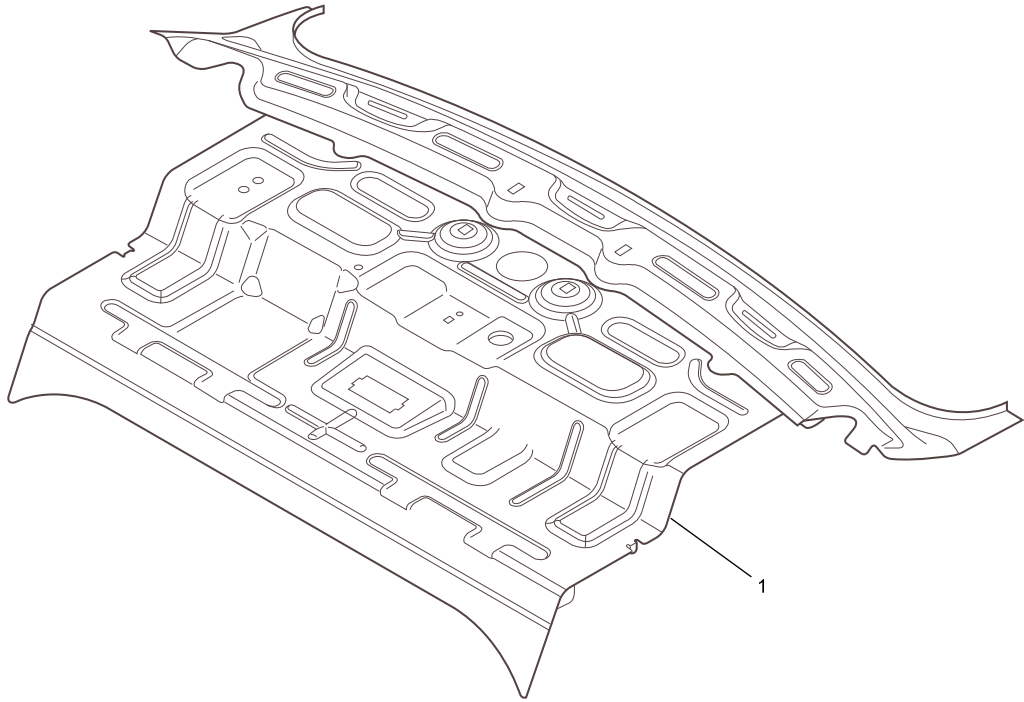
Wheel House Plate



S882026

1. Rear Wheel House Outer Plate Assembly RH
2. Rear Wheel House Outer Plate Assembly LH
3. Rear Wheel House Inner Extension Plate RH
4. Rear Wheel House Inner Extension Plate LH
5. Rear Wheel House Inner Plate Assembly LH
6. Rear Wheel House Inner Plate Assembly RH
7. Rear Wheel House Extension Plate Assembly LH
8. Rear Wheel House Extension Plate Assembly RH
9. Rear Side Cover Assembly LH
10. Rear Side Cover Assembly RH

Parcel Shelf



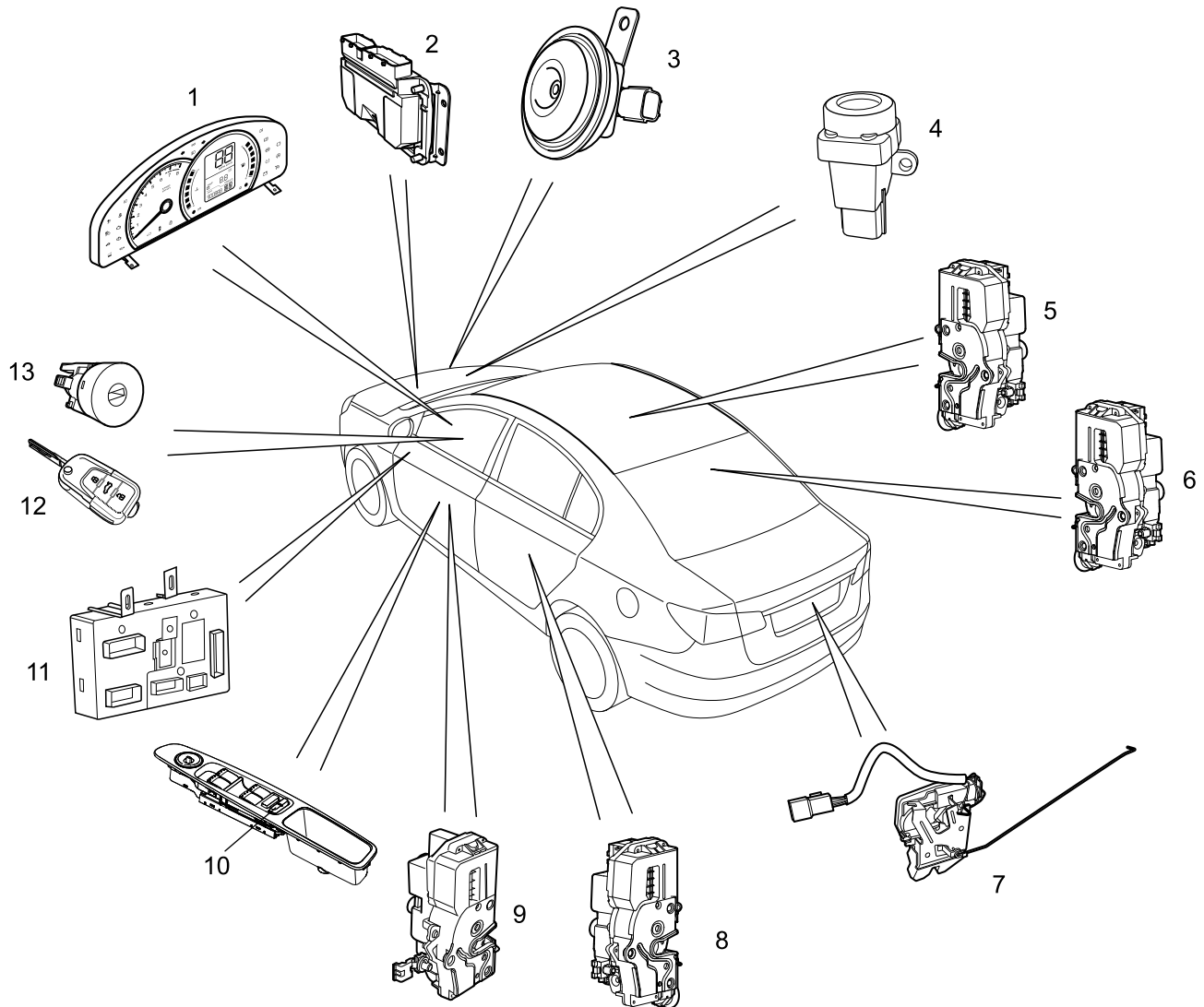
S882027

I. Parcel Shelf Assembly

Vehicle Access

Description and Operation

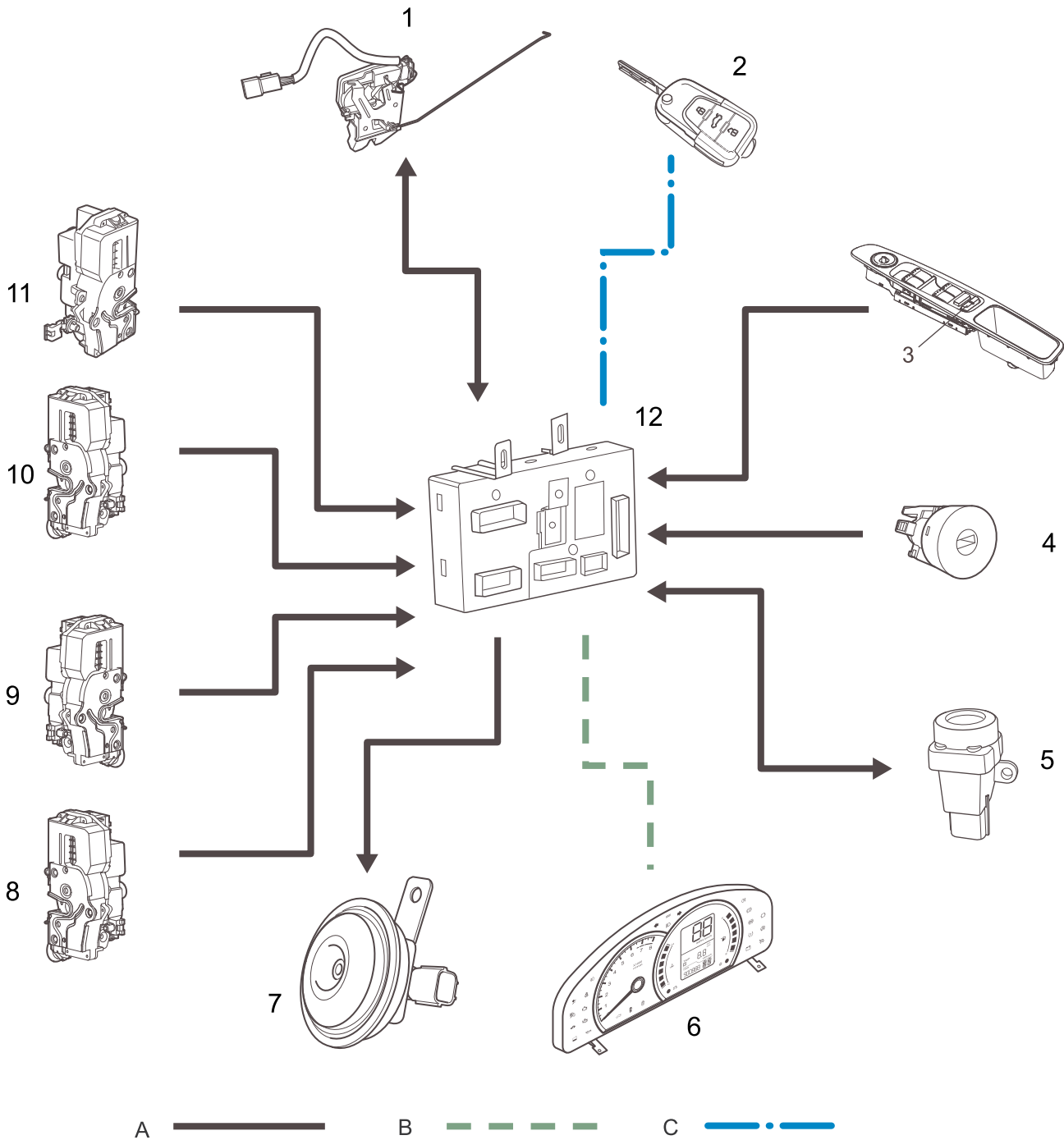
System Component Layout



1. Instrument Pack
2. Engine Control Module
3. Horn
4. Inertia Switch
5. Front Passenger Side Door Lock Body Assembly
6. Rear Door Lock Body Assembly RH
7. Boot Lock Body Assembly
8. Rear Door Lock Body Assembly LH
9. Driver Side Door Lock Body Assembly
10. Hazard Warning Light Switch
11. Body Control Module
12. Wireless Key
13. Ignition Switch

System Control Diagram

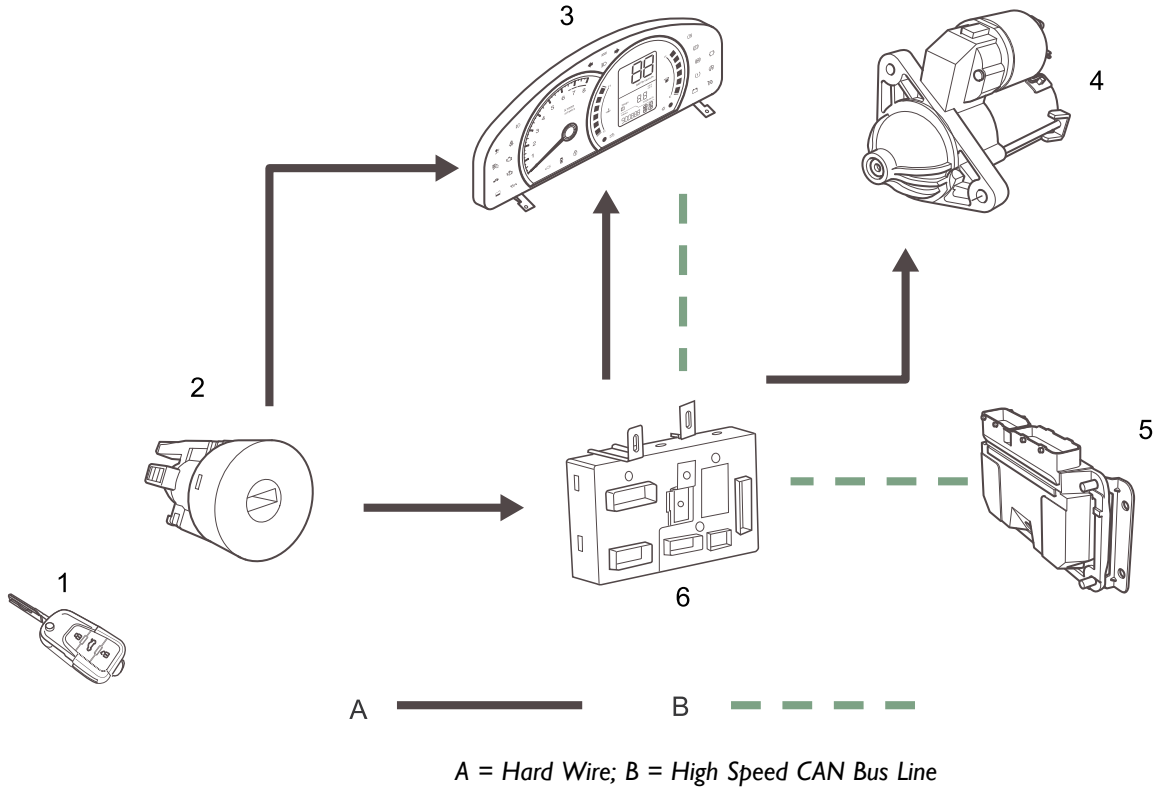
Security and Lock System Control Diagram



A = Hard Wire; B = High Speed CAN Bus Line; C = Radio Frequency Signal

- 1. Boot Lock Body Assembly
- 2. Wireless Key
- 3. Hazard Warning Light Switch
- 4. Ignition Switch
- 5. Inertia Switch
- 6. Instrument Pack
- 7. Horn
- 8. Front Passenger Side Door Lock Body Assembly
- 9. Rear Door Lock Body Assembly RH
- 10. Rear Door Lock Body Assembly LH
- 11. Driver Side Door Lock Body Assembly
- 12. Body Control Module

Immobilizer System Control Diagram



- 1. Wireless Key
- 2. Ignition Switch
- 3. Instrument Pack
- 4. Starter Motor
- 5. Engine Control Module
- 6. Body Control Module

Description

Safety System

The function of safety system is to prevent the vehicle from starting unlawfully. When the ignition switch is turned to "AUX", immobilizer system can be unset by the transmitter of the wireless key of the vehicle, the transmitter is recognised by the reader coil around the ignition switch, the coil sends power and data in a certain frequency to the wireless key in a specific range away from the reader coil. If the **BCM** detects an alarm trigger, the alarm will be activated. The safety system includes:

- Alarm Horn
- Door Switch
- Bonnet Switch
- Boot Switch
- Security Warning Light
- Hazard Warning Light Button
- Wireless Key
- Ignition Switch
- Body Control Module (BCM)
- RF Receiver

Alarm Horn

Power to the horn through engine compartment NO.32 fuse and NO.13 relay. The relay is controlled by the **BCM**. When the **BCM** detects the alarm trigger, the horn will alarm intermittently by connecting and disconnecting the ground circuit of the relay coil.

Door Switch

Each door lock body assembly includes a microswitch to inform the **BCM** of the condition of the door. When the door is opened, the microswitch contact points close, and connect to the ground circuit of the **BCM**. When the door is closed, microswitch contact points disconnect the connection and turn to open. The door switch and the open switches of the bonnet and the boot are the main components of the alarm system. When the alarm system is operating, the switches will monitor the outer forcible invasion. The door open signal is also used by the **BCM** to display the status of the door and control the interior light on the instrument pack information centre.

Boot Switch

The boot lock motor includes a microswitch to inform the **BCM** of the condition of the trunklid. When the trunklid is closed, the microswitch contact points disconnect and the circuit of the **BCM** turns to open. When the trunklid is opened, the switch turns off and the ground circuit of the **BCM** turns on. **CAN** bus line will trigger the alarm when it monitors a ground circuit that connected. The boot open

microswitch is also used by the **BCM** to display the status of the boot and control the interior light automatically on the instrument pack information centre.

Bonnet Switch

The bonnet immobilizer system switch is located on the modular front end panel. When the bonnet is closed, the microswitch contact points open and the ground circuit of the **BCM** disconnects. When the engine is opened, the switch closes and forms a complete circuit. If the alarm is operating, the **BCM** will sense the circuit closing and trigger the alarm. The bonnet switch is also used to display the status of the bonnet on the instrument pack information centre.

Operation**Lock or Unlock Outer Section by the Wireless Key**

- When pressing the unlock key of the wireless key to unlock, all the four doors are unlocked simultaneously, the direction indicator flashes once for 2 seconds to indicate that the door lock is unlocked successfully.
- When pressing the lock key of the wireless key to lock, all the four doors are locked simultaneously, the direction indicator flashes three times to indicate that the vehicle is locked safely; at the same time the lock reminder light of the instrument panel flashes; if the lock key is pressed continuously twice in one second, the super-lock function is activated (the door can't be opened by the inside grip), at the same time the lock reminder light of instrument panel flashes. (super-lock function refers to the real vehicle)
- When the ignition switch is turned off with zero speed, press the open key of the boot on the wireless key for more than 1 second, the boot can be unlocked successfully.

Lock or Unlock with the Driver Side Door Lock Mechanism

When the door lock mechanism is operated by the mechanical key, the driver side door lock switch is turned to open position for less than 2 seconds, all the doors are unlocked simultaneously, at the same time the direction indicator flashes once, the door is unlocked successfully; when the driver side door lock switch is turned to close position for less than 2 seconds, the four doors are locked simultaneously, the direction indicator flashes three times and the lock reminder light on the instrument panel flashes.

Lock or Unlock by the Central Lock Switch

- When the inertia switch is not activated or the impact sensors are not triggered with the driver door closed, all the doors are locked simultaneously by pressing the lock key of the central lock, the lock reminder light on the instrument panel remains on. The super-lock function can't be activated by the central lock key. (super-lock function refers to the real vehicle)
- All the door locks can be opened by pressing the unlock key of the central lock with the inner section locked.
- The door lock will unlock automatically when the inertia switch or the impact sensor is triggered while a collision occurs. And the door lock mechanism will not be locked again by pressing the lock switch of the central lock in the current ignition period.
- The central lock switch will not operate when locking the outer section or in the super-lock. (super-lock function refers to the real vehicle)

Unlock by the Fuel Inertia Switch or the Impact Sensor

- When the ignition switch is on and is not in status of locking the outer section, trigger the inertia switch and the door will unlock automatically.
- Except the condition of locking the outer section, the door will unlock automatically when the impact sensor receives the collision signals.

Auto Return Lock

The vehicle will return to the lock status automatically if it's unlocked by the wireless key and has no operation in 30 seconds.

If in the auto return lock status, turn the ignition switch to "AUX" position, or there is an effective key, the current time of the return lock timer will be cancelled and the auto return lock function will be cancelled.

Unlock Automatically

Turn the ignition switch off when the vehicle is in inner section lock status, the vehicle will unlock automatically.

Warm Lock

When the engine is running and the vehicle is stopped, the vehicle can be locked by the wireless key, but the alarm system of the vehicle will not operate.

Lock Related to the Speed

When the driver side door is well closed with the vehicle is in unlock status, the door will lock automatically after the speed reaches to the value (preset). The lock function related to the speed is set to close in default.

Unlock the Boot Lock by the Release Switch

- When the vehicle is in inner section lock status or the vehicle is running, the boot will not be opened by pressing the release switch.
- When the door is unlocked, the boot can be opened by pressing the release switch.

Confinement Alarm

When the vehicle is locked from the outside by the wireless key or the driver door lock mechanism in the following conditions, the BCM will active the horn alarm for 25 ms to indicate that a confinement occur:

- Any door is opened.
- When the ignition switch is in position 1, position 2 or position 3.
- The engine is running (all the doors are well closed and the warm lock function is activated, the confinement alarm function will be prohibited now).

The Operation Condition of the Safety Alarm

In the following conditions, the **BCM** makes the safety system operate completely:

- All doors are closed.
- Remove the wireless key.
- Receive the request for effective lock of the wireless key.
- Receive the request for the effective lock of the panic key when using it.

At this time, the direction indicator flashes three times to confirm the vehicle is in operation. Note: If the driver door is opened, the **BCM** receives the request to lock, the **BCM** will not active the safety system.

If causing the confinement with the system is operating and the door is not closed completely, the **BCM** will make the system to be in partial operation.

In the following conditions, the **BCM** makes the safety system does not operate at all:

- Receive the request for effective unlock of the wireless key.
- Receive the request for effective unlock of the driver door panic key (in such a case, if the effective unlock request of the wireless key is not received after 30 seconds or the effective ignition key is inserted, the safety system will operate, the alarm will trigger).
- Insert the effective ignition key.

The direction indicator flashes 2 seconds once to confirm the vehicle is not in operation condition.

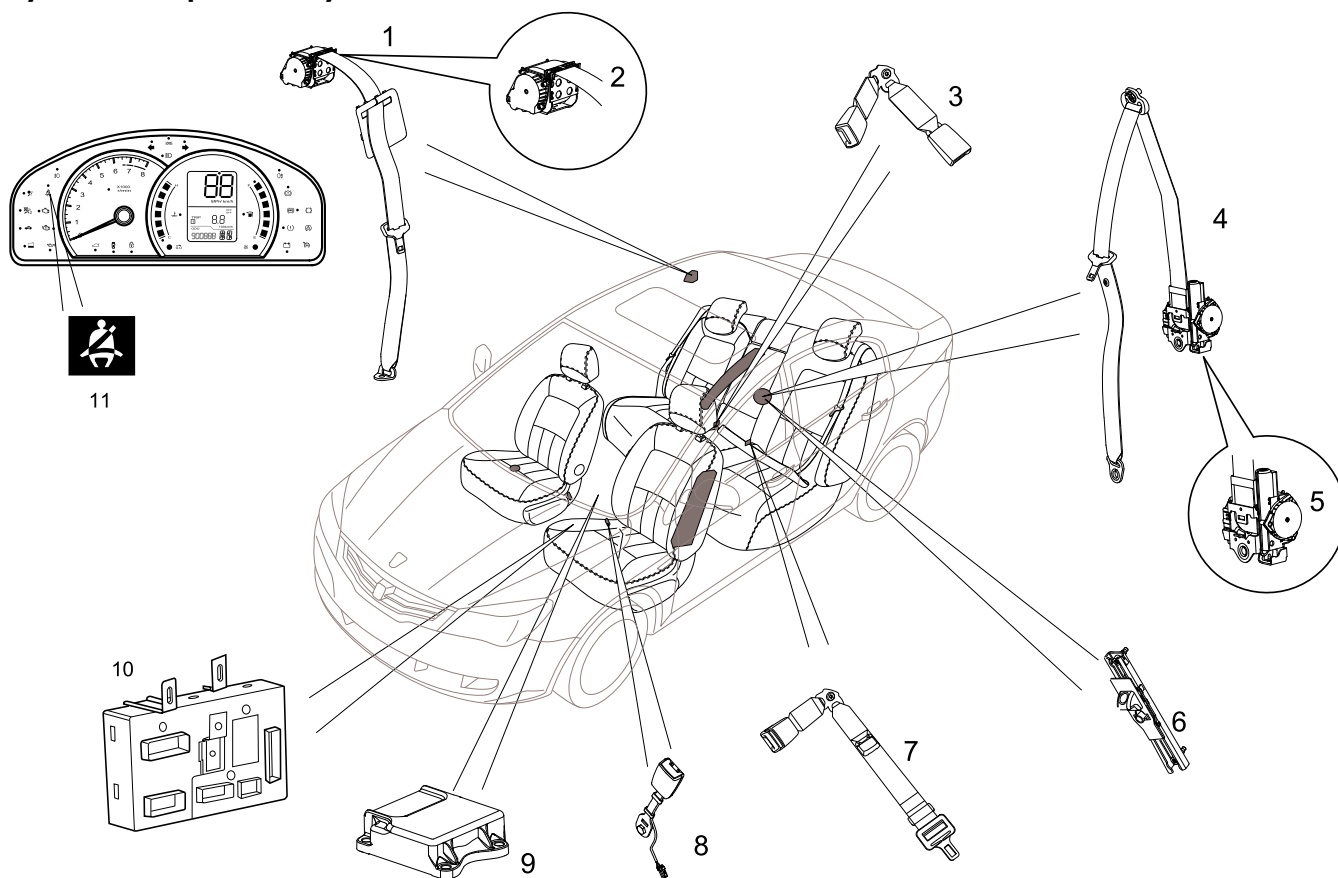
The wireless key can be used to release alarm, but the panic key can't be used to do that.

**Seat Belts
Specifications
Torque**

| Description | Value |
|--|----------|
| Bolt - Front Seat Belt Retractor to B and C Pillar | 35-45 Nm |
| Seat Belt Vertical Adjuster Assembly - Front Seat (LH) | 35-45 Nm |
| Bolt - Front Seat Belt | 35-45 Nm |
| Bolt - Rear Seat Buckle Assembly | 45-55 Nm |
| Bolt - Long End of the Rear Seat Belt to Body | 45-55 Nm |
| Child Restraint Fixed Point Assembly - Lower Rear Seat | 45-55 Nm |

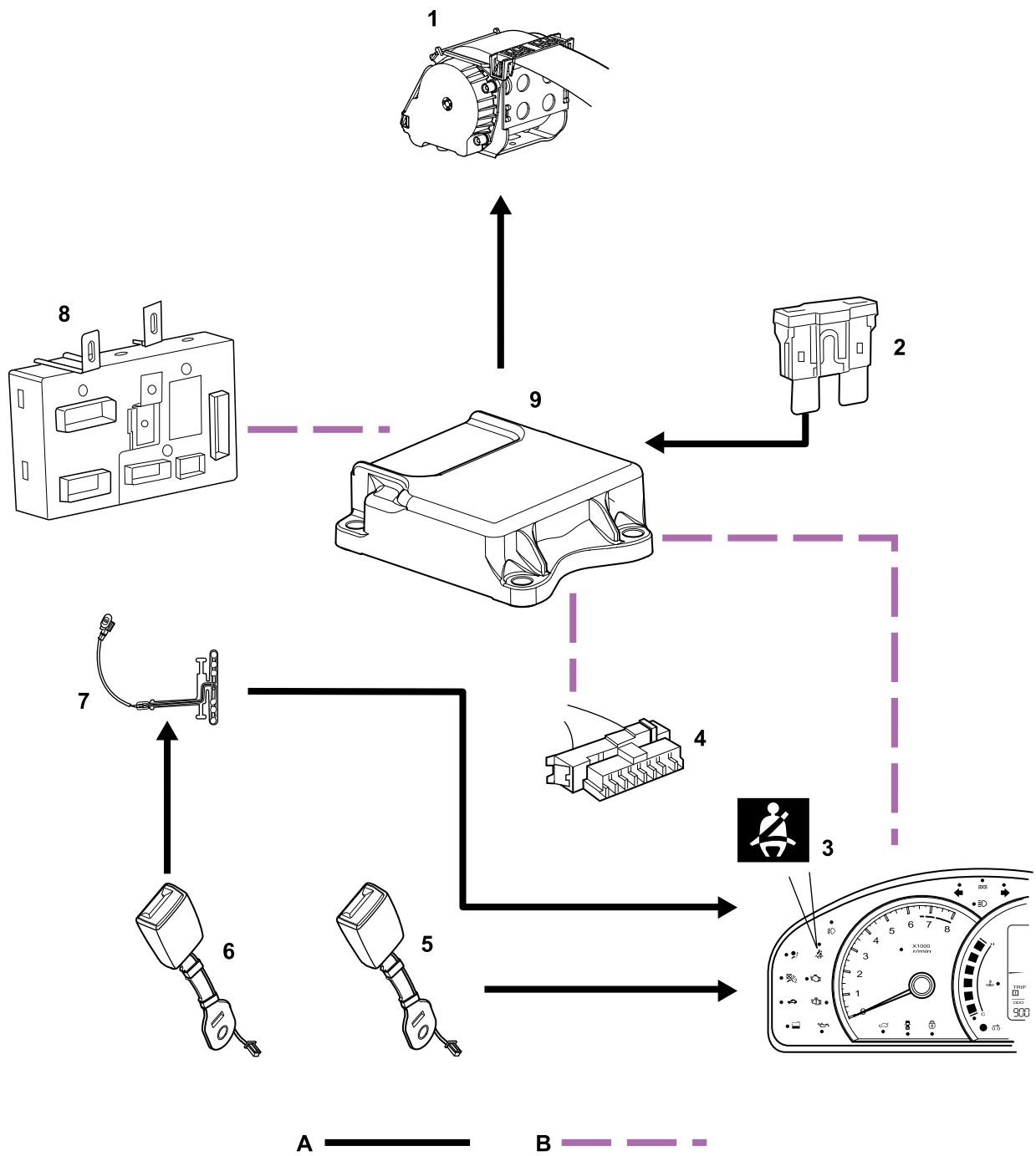
Description and Operation

System Component Layout



- | | |
|--|---|
| 1. Rear Seat Belt Assembly | 7. Rear Seat Centre Lap Belt and Buckle |
| 2. Rear Seat Belt Retractor | 8. Driver Seat Belt Buckle (W/alarm function) |
| 3. Rear Seat Belt Double Buckle | 9. Airbag Control Diagnostic Unit |
| 4. Front Seat Belt Assembly | 10. Body Control Module |
| 5. Front Seat Belt Retractor with Pretensioner | 11. Seat Belt not Fastened Warning Light |
| 6. Front Seat Belt Vertical Adjuster Assembly | |

System Control Diagram

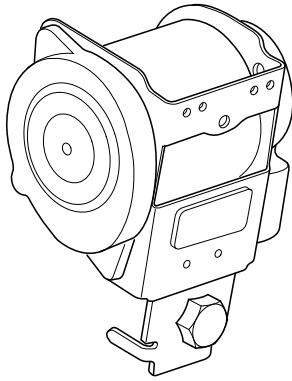


A = Hard Wire; B = High Speed CAN Bus Line

- | | |
|---|--|
| 1. Seat Belt Retractor | 6. Passenger Side Seat Belt Buckle |
| 2. Passenger Compartment Fuse F05 | 7. Occupant Seat Occupied Sensor (if equipped) |
| 3. Seat Belt not Fastened Warning Light | 8. Body Control Module |
| 4. Diagnostic Socket | 9. Airbag Control Diagnostic Unit |
| 5. Driver Side Seat Belt Buckle | |

Description

Front Seat Belt Pretensioner



S133002

When collision occurs, the front seat belt pretensioner unit will retract to ensure the occupants are firmly kept in their own position. Secure the seat belt pretensioner unit to the seat belt inertia retractor assembly of the B and C pillar with the bolt. The connector of the seat belt pretensioner unit is a 2-pin connector that is connected to the body wire.

When collision occurs, the seat belt pretensioner unit controls through the signal delivered from **SRS ECU**. The alignment and operation of the two pretensioner unit inertia scrolls are the same. Each pretensioner unit is equipped with an initiator and a propellant generator, which act on the rotor of the seat belt inertia reel.

Warning: *Once the pretensioner has been operated, it can't be reset. So it is necessary to replace the pretensioner.*

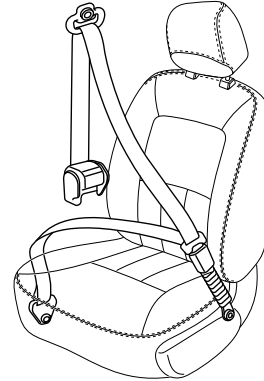
Seat Belt

Seat belt provides the basic protection for all occupants. The supplemental restraint system also provides a further protection for the front seat occupants by using the airbag module and the pretensioner seat belt. The front seats are equipped with the appropriate inertia retractor and three-point type seat belt. The inertia retractor of the vehicle is an emergency lock retract (**ELR**) type.

The inertia retractor appends to an additional lock-up mechanism with webbing sensor and auto sensor. If the webbing is pulled suddenly, the webbing sensor activates the lock-up mechanism immediately. If the vehicle decelerates suddenly or has a large-angle tilting, the auto sensor activates the lock-up mechanism.

As the retractor locks when collision occurs, front seat belt retractor is equipped with a load limiter. If the limited load is more than the critical level, the load limiter makes the webbing loose, so the load acting on the occupants decreases.

Front Seat Belt

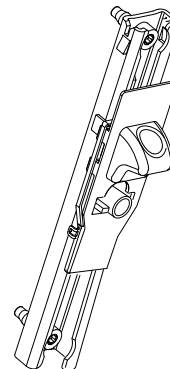


S133003

The inertia retractor of the front seat belt is fitted on the vehicle, it's located in the cavity of the bottom of the B and C pillar lower trim panel. The webbing of the belt is pulled out from the inertia retractor, and it secures on the mounting point of the bottom of the B and C pillar by a manual vertical adjustment unit of the upper side of the B and C pillar.

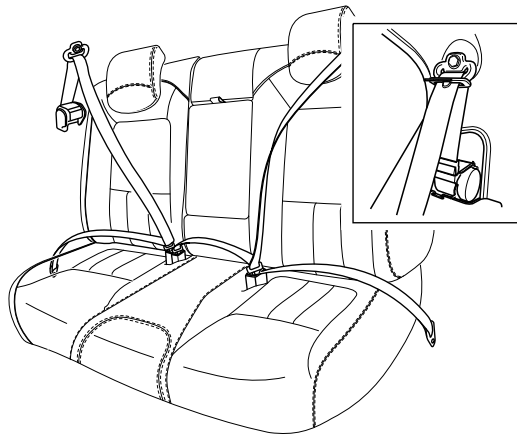
Vertical Adjustment Unit

The vertical adjustment unit is secured on the upper side of the B and C pillar with bolts. The webbing of the seat belt is secured on the vertical adjustment unit through D-ring, and by sliding the vertical adjuster up and down to meet the optimal position of belt in various conditions. The seat belt buckle assembly is fitted on the bracket of the seat frame inside.



S133004

Rear Seat Belt

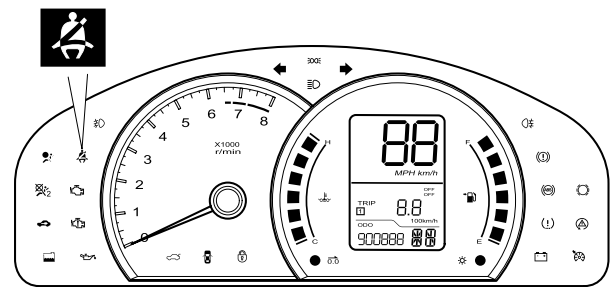


The inertia retractor of the rear seat belt is secured on the white body under the rear parcel shelf trim panel with bolts. The webbing of the belt is pulled out from the inertial retractor through the parcel shelf decoration. The another end of the webbing is secured on the mounting point of the body floor, the centre seat belt is secured under the rear seat.

The buckle of the rear seat belt RH and the centre seat belt buckle are secured on the same point. The rear seat belt buckle LH is located on the right coxa of the occupants.

The rear seat belt buckle RH and the centre seat belt buckle are an assembly, it is secured between the rear seat RH and the centre seat with a bolt. The seat belt of the centre seat passenger is connected to the striker of right coxa through left coxa.

Seat Belt Alarm Indication



S133006

The front seat belt buckle integrates with the seat belt not fasten alarm switch, it connects to the instrument pack by the **SRS ECU**. If the vehicle moves with the seat belt not fastened, the seat belt alarm will be triggered. The warning message includes a sound alarm and a warning light alarm that flashes on the instrument panel. For some vehicle specifications, to avoid causing the unnecessary alarm without passenger, a pressure sensor is fitted inside the passenger seat. If there is a passenger, but the pressure sensor is not activated, the seat belt alarm will not be triggered even if the seat belt is not fastened.

Operation

SRSECU triggers the operation of the pretensioner seat belt:

- For the front seat belt, the initiator and the propellant generator inside the seat mounting buckle assembly act

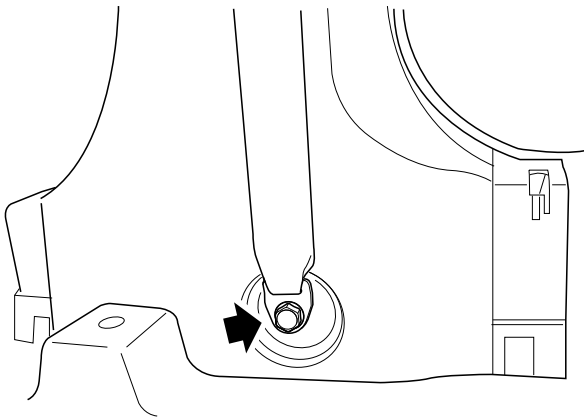
on the rotor of the seat belt inertia reel, the seat belt is tightened and the tension is increased to ensure the occupants are limited in their positions after a collision.

Service Procedures

Front Seat Belt Assembly

Removal

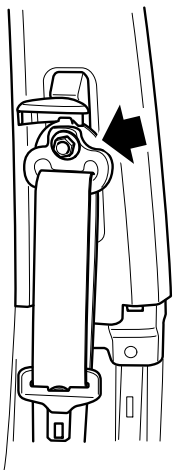
1. Remove the key from the ignition switch, disconnect the connection of the positive and negative of the battery (disconnect the earth lead first). Wait for 10 minutes, the operation can be started after the **SRS** stand-by circuit discharging completely.
2. Remove the pad, and unscrew a bolt securing the front seat belt fixed end to the B and C pillar lower trim panel.



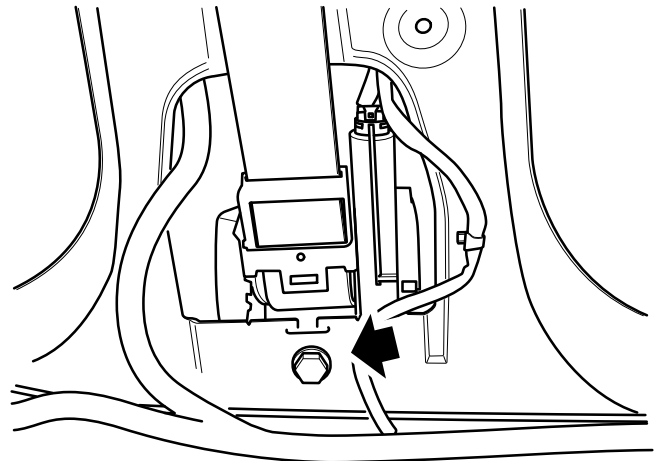
3. Remove the B and C pillar lower trim panel.

B and C Pillar Lower Trim Panel

4. Open the pad, and unscrew a bolt securing the front seat belt D-ring to the vertical adjuster.



5. Disconnect the electrical connector.
6. Unscrew a bolt securing the front seat belt retractor to the body.



7. Remove the front seat belt assembly.

Refit

1. Secure the front seat belt retractor to the body, fit the bolt and tighten to **35-45 Nm**.
2. Connect the electrical connector.
3. Secure the front seat belt D-ring to the vertical adjuster, fit the bolt and tighten to **35-45 Nm**.
4. Fit the B and C pillar lower trim panel.

B and C Pillar Lower Trim Panel

5. Secure the front seat belt fixed end to the B and C pillar lower trim panel, fit the bolt and tighten to **35-45 Nm**.
6. Perform system inspection, turn the ignition switch, check if the SRS warning light illuminates for 4 seconds, and then turns off.

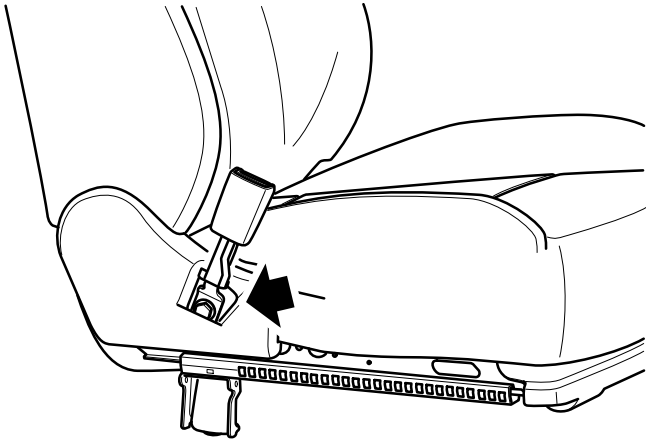
Front Seat Belt Buckle

Removal

1. Remove the front seat assembly.

Front Seat Assembly

2. Unscrew a bolt securing the front seat belt buckle to the seat.



Refit

1. Secure the front seat belt buckle to the seat, fit the bolt and tighten it.
2. Fit the front seat assembly.

Front Seat Assembly

Front Seat Belt Vertical Adjuster

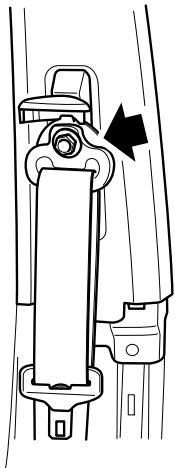
461A006

Removal

1. Remove the key from the ignition switch, disconnect the connection of the positive and negative of the battery (disconnect the earth lead first). Wait for 10 minutes, the operation can be started after the **SRS** stand-by circuit discharging completely.
2. Remove the B and C pillar lower trim panel assembly.

B and C Pillar Lower Trim Panel Assembly

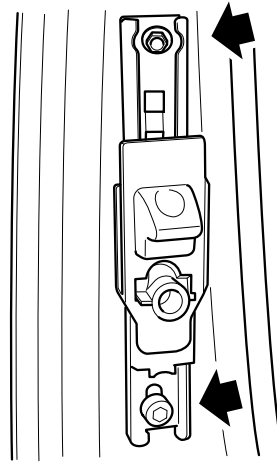
3. Open the pad, and unscrew a bolt securing the front seat belt D-ring to the vertical adjuster.



4. Remove the B and C pillar upper trim panel assembly.

B and C Pillar Upper Trim Panel Assembly

5. Unscrew 2 bolts securing the front seat belt vertical adjuster to the body.



6. Remove the front seat belt vertical adjuster.

Refit

1. Secure the front seat belt vertical adjuster to the body, fit the bolt and tighten to **35-45 Nm**.
2. Fit the B and C pillar upper trim panel assembly.

B and C Pillar Upper Trim Panel Assembly

3. Secure the front seat belt D-ring to the vertical adjuster.
4. Fit the B and C pillar lower trim panel assembly.

B and C Pillar Lower Trim Panel Assembly

5. Perform system inspection, turn the ignition switch, check if the **SRS** warning light illuminates for 4 seconds, and then turns off.

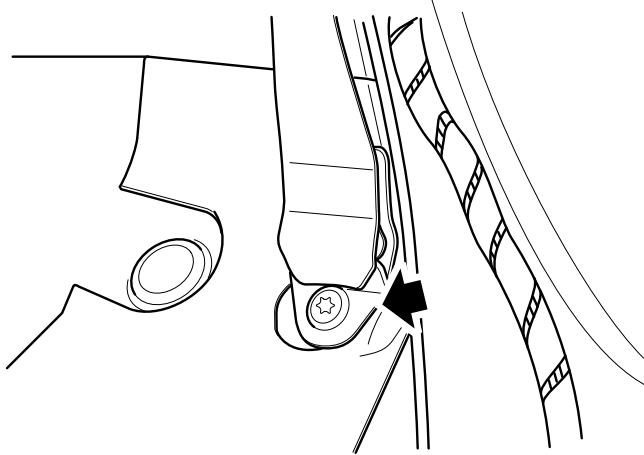
Rear Seat Belt Assembly

Removal

1. Remove the rear seat.

 **Rear Seat**

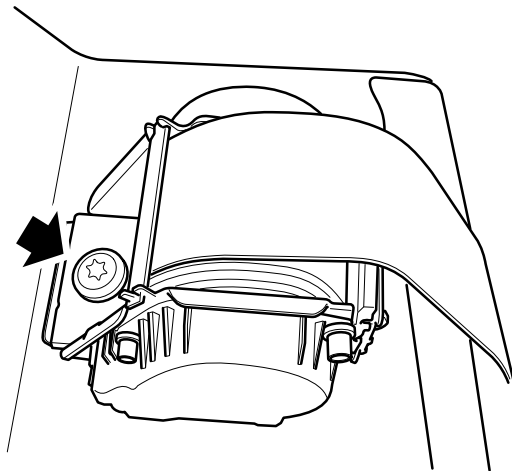
2. Unscrew a bolt securing the rear seat belt to the body.



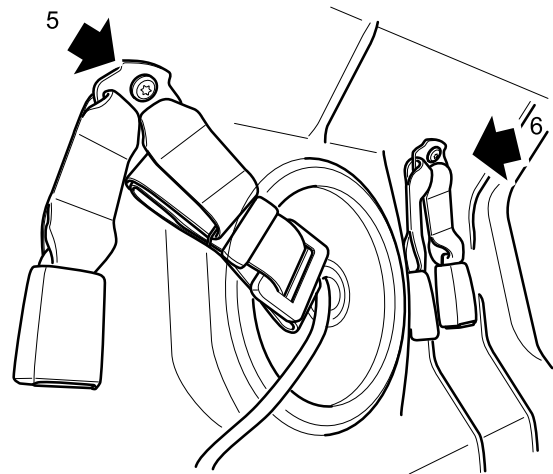
3. Remove the luggage parcel shelf.

 **Luggage Parcel Shelf**

4. Unscrew a bolt securing the rear seat belt retractor to the body, and remove the retractor.



5. Unscrew a bolt securing the rear seat centre belt to the body, remove the rear seat centre belt.
6. Unscrew a bolt securing the rear seat belt double buckle to the body, remove the rear seat belt double buckle.



Refit

1. Position the rear seat centre belt and the rear seat centre belt buckle to the body, fit the bolt and tighten to **45-55 Nm**.
2. Position the rear seat belt retractor to the body, fit the bolt and tighten to **45-55 Nm**.
3. Fit the luggage parcel shelf.

 **Luggage Parcel Shelf**

4. Position the rear seat belt to the floor, fit the bolt and tighten to 45-55 Nm.
5. Fit the rear seat.

 **Rear Seat**

Child Restraint System

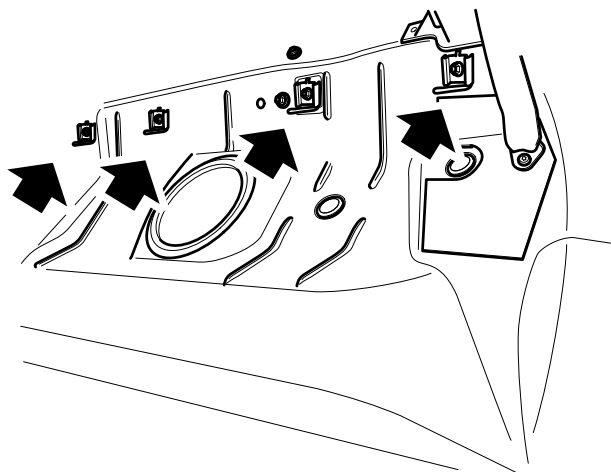
1.

Removal

1. Remove the rear seat assembly.

Rear Seat Assembly

2. Unscrew 4 bolts securing the child seat lower anchorage point bracket to the respective mounting holes of the white body floor.



Refit

1. Secure the child seat lower anchorage point bracket to the appropriate mounting holes of the white body floor, fit the bolts and tighten to **45-55 Nm**.
2. Fit the rear seat assembly.

Rear Seat Assembly

Supplemental Inatable Restraints**Specifications****Torque**

| Description | Value |
|---|------------|
| Screw - Driver Side Front Airbag Module to Steering Wheel | 10-15 Nm |
| Screw - Front Passenger Side Front Airbag Module to Instrument Panel Frame Assembly | 4.5-5.5 Nm |
| Bolt - Front Collision Sensor | 7-9 Nm |
| Bolt - Seat Side Collision Sensor | 7-9 Nm |

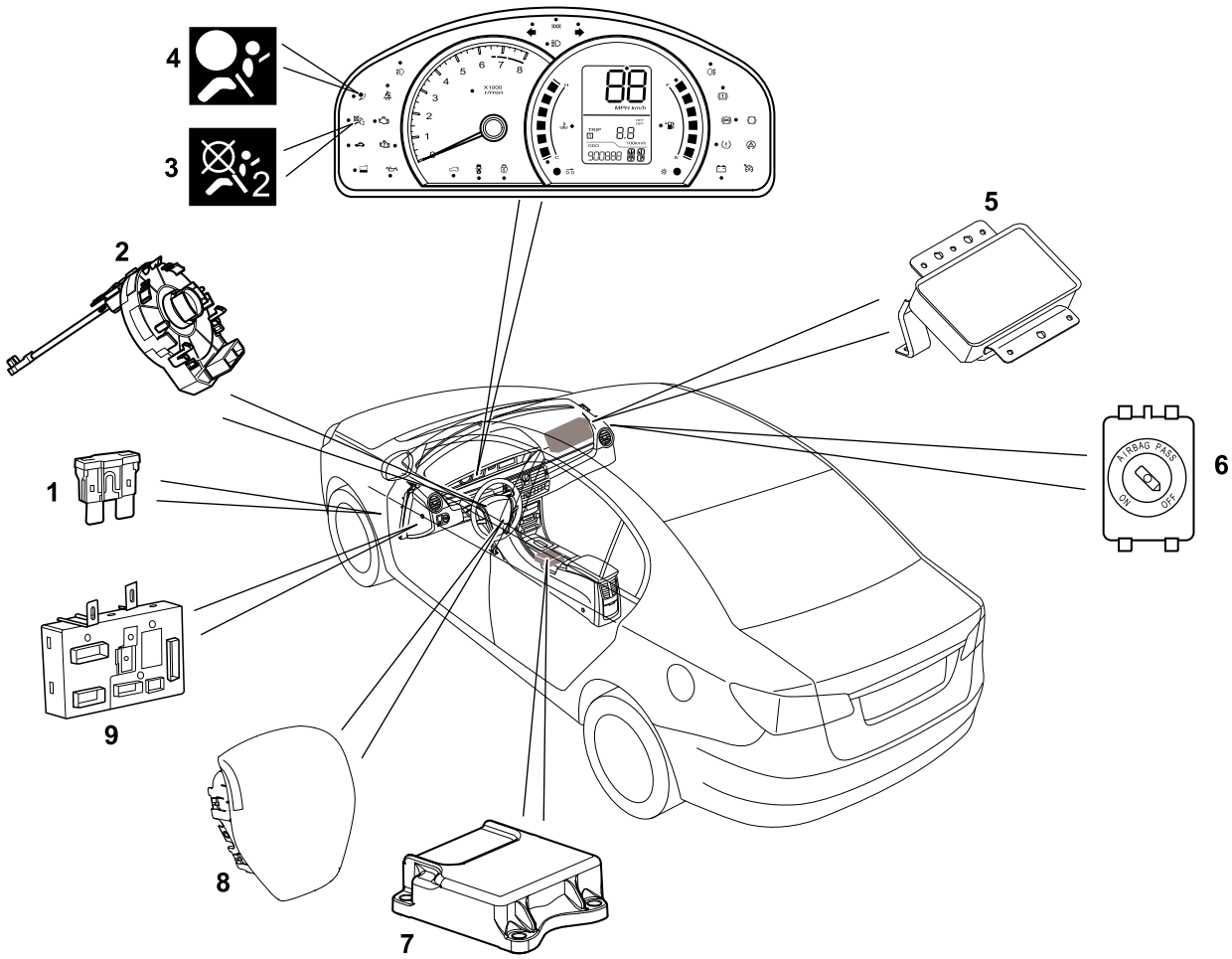
Resistance Value

| | Minimum (ohm) | Normal value (ohm) | Maximum (ohm) |
|------------------------------------|---------------|--------------------|---------------|
| Driver Side Airbag | 2.26 | 2.76 | 3.35 |
| Passenger Side Airbag | 1.92 | 2.28 | 2.64 |
| Driver Side Seat Belt Pretensioner | 2.24 | 2.48 | 2.76 |
| Passenger Side Belt Pretensioner | 2.24 | 2.48 | 2.76 |
| Driver Side Thorax Airbag | 2.12 | 2.58 | 2.94 |
| Passenger Side Thorax Airbag | 2.16 | 2.62 | 2.98 |
| Driver Side Curtain Airbag | 2.32 | 2.58 | 2.84 |
| Passenger Side Curtain Airbag | 2.32 | 2.58 | 2.84 |

Description and Operation

System Component Layout

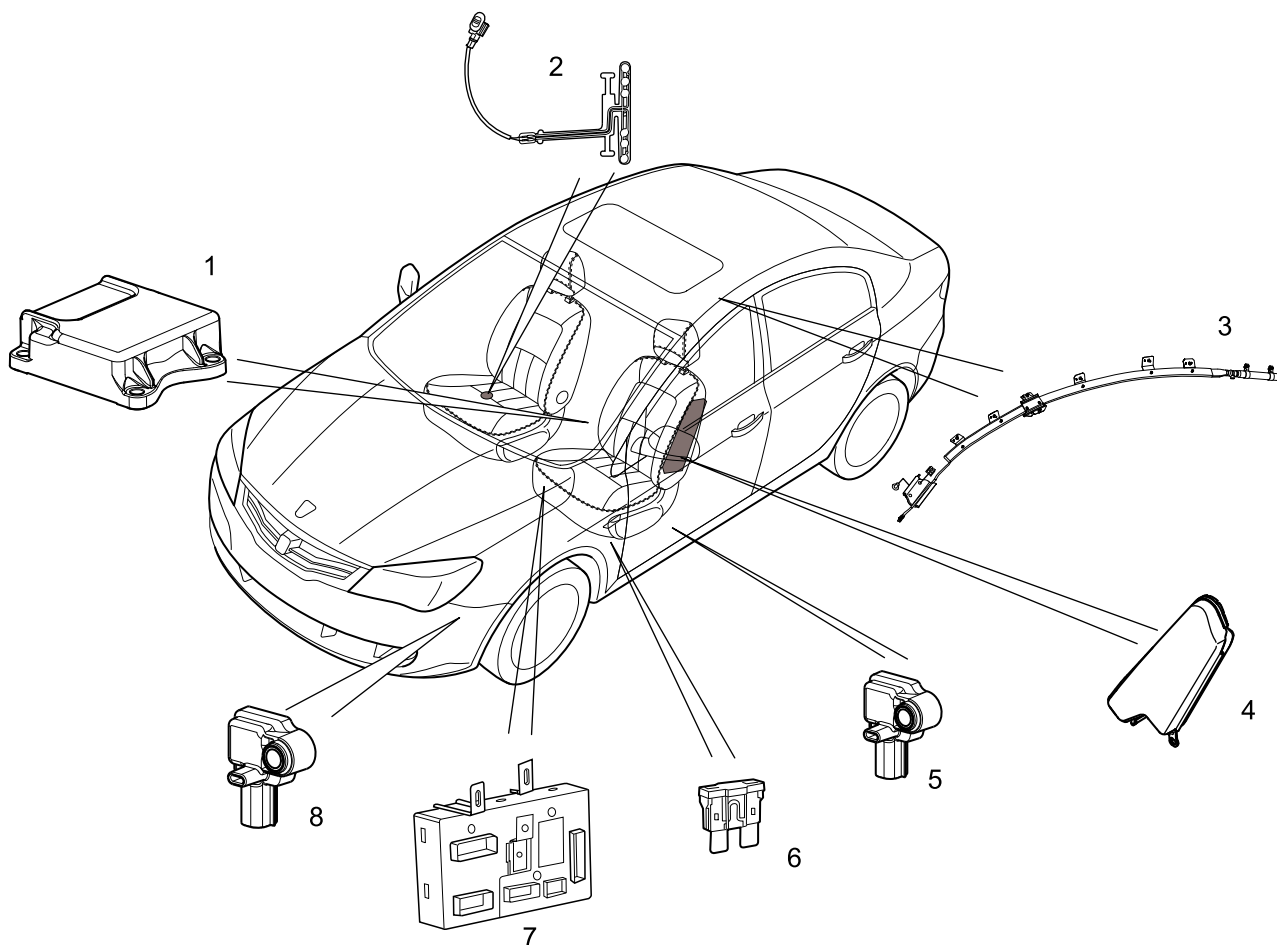
Airbag Component Layout



- 1. Passenger Compartment Fuse F05
- 2. Rotary Coupler
- 3. Passenger Side Airbag Disabled Indicator
- 4. Airbag Warning Light
- 5. Passenger Side Airbag

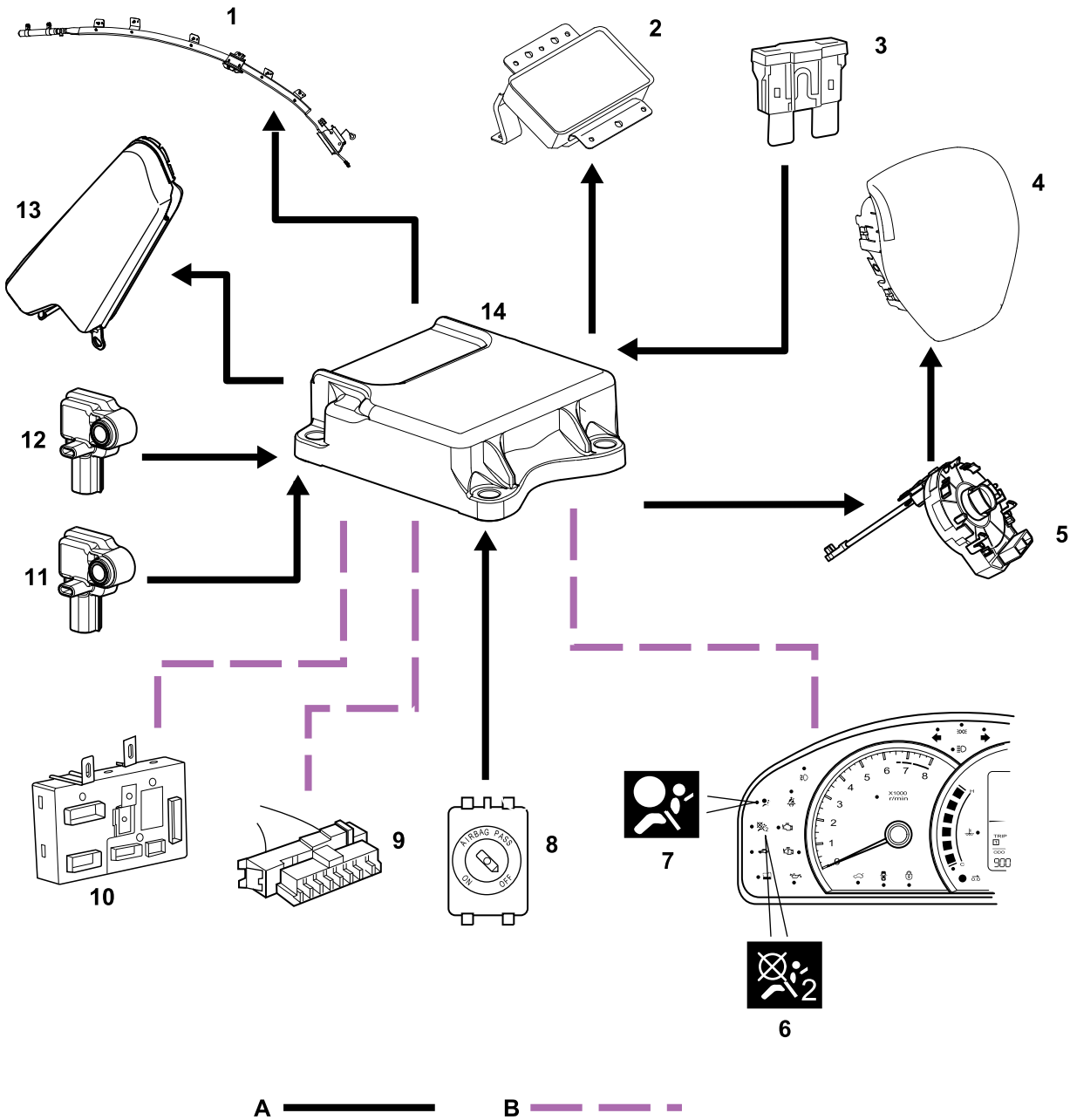
- 6. Passenger Side Airbag Disabled Switch
- 7. Airbag Control Diagnostic Unit
- 8. Driver Side Airbag
- 9. Body Control Module

Airbag Component Layout



- | | |
|-----------------------------------|-----------------------------------|
| 1. Airbag Control Diagnostic Unit | 5. Side Impact Sensor |
| 2. Passenger Seat Occupied Sensor | 6. Passenger Compartment Fuse F05 |
| 3. Head Curtain Shield Airbag | 7. Body Control Module |
| 4. Seat Side Airbag | 8. Front Impact Sensor |

System Control Diagram
Airbag Control Diagram



A = Hard Wire; B = High Speed CAN Bus Line

- | | |
|---|--|
| 1. Head Curtain Shield Airbag Kit | 8. Passenger Side Airbag Disabled Switch |
| 2. Passenger Side Airbag Module | 9. Diagnostic Socket |
| 3. Passenger Compartment Fuse F05 | 10. Body Control Module |
| 4. Driver Side Airbag Module | 11. Side Impact Sensor |
| 5. Rotary Coupler | 12. Front Impact Sensor |
| 6. Passenger Side Airbag Disabled Indicator | 13. Seat Side Airbag |
| 7. Airbag Warning Light | 14. Airbag Control Diagnostic Unit |

Description

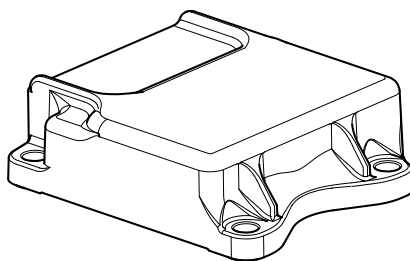
General Description

Supplemental restraint system (**SRS**) can enhance the passive protection of the occupants on the vehicle when severe impact occurs. The unit is founded on the basis that the standard protection system (seat belt) has been used. The system operates automatically, it's unnecessary to communicate with the occupants in the vehicle beforehand, so it's called passive protection system.

The supplemental restraint system**SRS** includes the following components:

- Supplemental Restraint System Diagnostic and Control Unit (**SRS ECU**)
- Driver Side Front Airbag Module
- Front Passenger Side Front Airbag Module
- Seat Side Airbag Module RH (if equipped)
- Seat Side Airbag Module LH (if equipped)
- Pretensioner Front Seat Belt (RH)
- Pretensioner Front Seat Belt (LH)
- Rear Seat Belt (RH)
- Rear Seat Belt (LH)
- Rear Seat Belt (LH)
- Impact Sensor LH (if equipped)
- Driver Side Seat Belt not Fastened Alarm Switch (if equipped)
- Rotary Coupler
- **SRS** Warning Light (in the Instrument Pack)

Supplemental Restraint System Diagnostic and Control Unit (SRS ECU)



SRSECU determines the collision manner and effect range by the inside and outside (if equipped) collision monitor sensor, and thus controls the operation of the supplemental restraint system. The sensor sends the side collision signal to**SRS ECU**, if the collision is higher than the predetermined value, the side airbag module and all the pretensioners of the appropriate

side of collision will be triggered.**SRSECU** is fitted on the centre console lower centre path under the centre console, and secured with three nuts.

SRSECU monitors the collision around the vehicle by the inner accelerometer and the impact sensor.**SRSECU** can distinguish severe collision or slight collision by the input data, or an impact results from an uneven road, and thus can ensure the airbag function effectively.

If it is monitored that the severity of the frontal collision exceeds the preset triggering value,**SRSECU** signals are sent to trigger front airbag module and seat belt pretensioner.

Two side impact sensors should be fitted to monitor the collision of the side collision if side airbag is fitted. If it is monitored that the severity of the side collision exceeds the preset triggering value,**SRSECU** signals are sent to trigger the appropriate side airbag module.

The main sensor is integrated into**SRS ECU**. When the severity of the impact is beyond the preset triggering value, each airbag trigger unit and seat belt pretensioner are triggered.

Caution: It is important that only SRS ECU is correctly mounted in the designated location, can you ensure the system operates properly.

Main sensor refers to the deceleration monitor unit including**SRS ECU**.

If it is monitored that the severity of the frontal collision exceeds the preset triggering value,**SRSECU** signals are sent to control the appropriate front airbag module and to trigger seat belt pretensioner.

For side collision, side impact sensor provides an additional input signal to**SRS ECU**, to combine with inner accelerometer of the**SRSECU** to confirm the collision.

For rear collision,**SRSECU** monitors the severity of the rear collision through the main sensor, if the severity is beyond the threshold that has set beforehand, the seat belt pretensioner will be triggered.

ECU Monitor

Warning: DO NOT connect any test equipment to SRS wire harness while SRS wire harness has connected to any SRS system component. As this may cause the components to be activated accidentally and lead to personal injury.

When powering up,**SRSECU** monitors the preparation of the protection unit module, after starting, SRS ECU monitors constantly.**SRSECU** can detect a short in the system and a short/current leak and an open of the battery.**SRSECU** monitors the conditions of the following modules:

- **SRSECU** Inner SRS ECU Accelerometer
- **SRSECU** Inner SRS ECU Safety Sensor
- **SRSECU** Microprocessor
- Side Impact Sensor (if equipped)
- Front Impact Sensor
- Front Airbag
- Side Airbag (if equipped)
- Head Curtain Shield Airbag (if equipped)
- Pretensioner of the Seat Belt
- Diagnostic Count

If the **SRS** warning light monitors a malfunction in the system or the component, it will illuminate to warn the driver. **SRSECU** tests the current of the airbag and the pretensioner trigger unit, and inspects the consistency of the related circuits.

The diagnostic equipment that is recommended can be used to inquire the **SRS** system malfunctions. The diagnostic information displayed includes the current malfunction message, the frequency of the malfunctions and the duration of a malfunction.

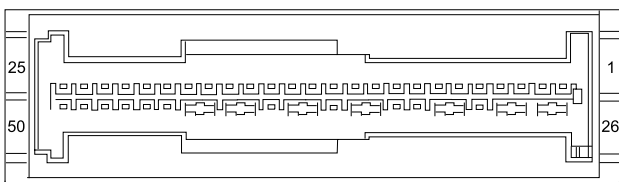
Power Supply and Reserve

The ignition power supplies a positive voltage to **SRSECU** via a special system fuse of the passenger side.

The power is supplied to the **SRS** warning light singly via fuse 5 in the passenger compartment fuse box. If the power supply malfunction occurs, inspect the passenger side fuse box and the **SRSECU** fuse and the connection of the wires. After starting the engine, the protection unit system is activated.

SRSECU includes a capacitor, which can store enough charges to ensure the appropriate trigger unit and ignition circuit operate in the condition that the conventional power is interrupted when collision occurs.

SRS ECU Connector End View



S134004

Connector Pin Detailed Information Chart

| Pin No. | Description |
|---------|--------------------------------------|
| 1 | Driver Side Airbag Positive |
| 2 | Driver Side Airbag Negative |
| 3 | Passenger Side Airbag Positive |
| 4 | Passenger Side Airbag Positive |
| 5 | No Connection |
| 6 | Driver Side Pretensioner Positive |
| 7 | Driver Side Pretensioner Negative |
| 8 | High Speed CAN |
| 9 | Low Speed CAN |
| 10 | Front Impact Sensor LH Positive |
| 11 | Front Impact Sensor LH Negative |
| 12 | No Connection |
| 13 | Passenger Side Pretensioner Positive |
| 14 | Passenger Side Pretensioner Negative |
| 15 | No Connection |
| 16 | Driver Side Impact Sensor Positive |
| 17 | Driver Side Impact Sensor Negative |
| 18 | Driver Side Airbag Positive |
| 19 | Driver Side Airbag Negative |
| 20 | Passenger Side Airbag Positive |
| 21 | Passenger Side Airbag Negative |
| 22 | No Connection |
| 23 | No Connection |
| 24 | Ground |
| 25 | Ignition |
| 26 | Short Circuit Protection |
| 27 | Short Circuit Protection |
| 28 | Short Circuit Protection |
| 29 | Short Circuit Protection |
| 30 | No Connection |
| 31 | Short Circuit Protection |
| 32 | Short Circuit Protection |
| 33 | Front Impact Sensor RH Positive |
| 34 | Front Impact Sensor RH Negative |
| 35 | Short Circuit Protection |
| 36 | Short Circuit Protection |
| 37 | Driver Side Curtain Airbag Positive |
| 38 | Short Circuit Protection |
| 39 | Short Circuit Protection |
| 40 | Driver Side Curtain Airbag Negative |
| 41 | Short Circuit Protection |
| 42 | Short Circuit Protection |

| | |
|----|--|
| 43 | Short Circuit Protection |
| 44 | Short Circuit Protection |
| 45 | Passenger Side Impact Sensor Positive |
| 46 | Passenger Side Impact Sensor Negative |
| 47 | Passenger Side Curtain Airbag Positive |
| 48 | Passenger Side Curtain Airbag Negative |
| 49 | Passenger Side Airbag Disabled Switch |
| 50 | No Connection |

Warning: *DO NOT use a multimeter or other general test equipment to test the SRS components, to prevent the airbag from unexpectedly deploying. System malfunctions can be diagnosed with the recommended diagnostic equipment only.*

Impact Sensor

Each sensor includes an electron circuit and a sensing unit. Side impact sensor delivers an acceleration signal to **ECU**, the **ECU** determines whether to trigger or not by calculating.

Caution: *The side collision sensors must be fitted in the correct orientation to ensure that the airbag works properly all the time.*

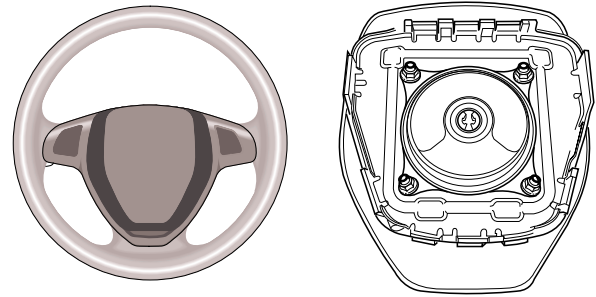
Driver Side Airbag Module

The driver side airbag module is fitted on the steering wheel with two bolts. The electrical connection to the **ECU** operates by the rotary coupler.

If a collision occurs, the sensor will send the collision signals to the **ECU**, then the **ECU** will determine whether the protection unit should be triggered or not according to the extent of the collision.

The driver side airbag module is triggered by the control signal of the **ECU**. Foldaway gas-bag, gas generator and trigger unit are in the module.

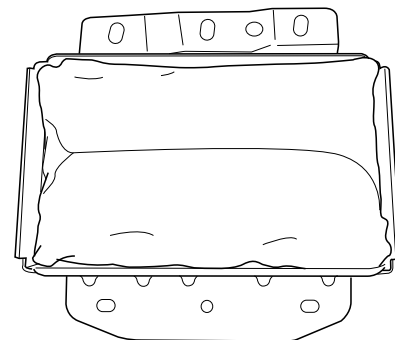
When a severe impact has been monitored by the **ECU**, the electronic switch will turn off, and thus will produce a small current to the trigger unit. The trigger unit generates heat and gas continuously by triggering to expand the gas-bag rapidly.



Passenger Side Front Airbag Module

Warning: *DO NOT drive the vehicle equipped with passenger airbag after the windshield is replaced for 24 hours.*

The passenger side front airbag module is fitted on the upside of the glove box of the instrument panel and the straight ahead of the passenger side seat. The airbag module is secured on the instrument panel with bolts. The passenger side front airbag module is triggered by the control signals of **SRS ECU**. Foldaway gas-bag and gas generator module are in the module. When **SRSECU** monitors a severe frontal collision, gas generator will be triggered to expand the nylon bag rapidly.



S134008

Passenger Side Airbag Disabled Switch

If a child safety seat is fitted on the passenger seat, the passenger side airbag disabled switch must be turned to "OFF". It prevents the children from being injured by detonating the airbag. The airbag disabled switch is located on the right side of the instrument panel, when the passenger side airbag disabled switch is in "OFF", the warning light on the instrument pack displays the status.

When there's no child safety seat or no children on the front passenger seat, the switch should be turned to normal "ON".



S134009

Seat Side Airbag (if equipped)

The seat side front airbag module is fitted on the frame of the seatback, it's designed to protect the side of the body when a side collision occurs. The side airbag module is triggered by the control signal of **ECU**, when a side collision or a angular frontal collision occurs to an enough severe degree, the side or the front airbag will be activated.

Foldaway nylon fibre bale, gas generating medium and trigger are in the side airbag module. The module is fitted on the seatback frame with two studs behind it, and secured in position with two nuts.

Warning: If a new airbag module has any sign of damage, DO NOT use it.

The side airbag module has a 2PIN black connector, the connector is connected to the **ECU** through the main wire harness, and fitted under the seat cushion.

Caution: DO NOT try to remove the connector at the airbag module end, as it is permanently connected.

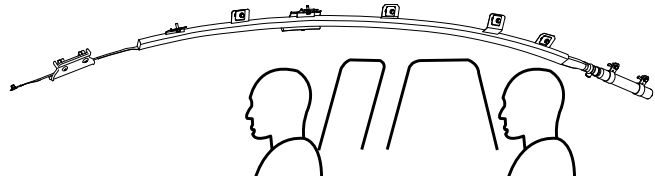
When the **ECU** monitors a severe side collision, the electronic switch will close, and the ignition trigger in the module will

receive the current. The triggered ignition medium generates heat and results in the combusting of nitrocellulose and generating nitrogen gas. The expanding gas from nitrocellulose chamber will break through the discharging port of the nitrogen gas/argon gas chamber. The high-pressure gas that comes out will expand the gas -bag rapidly. The inflation airbag makes the seam of the seatback fail as designed. Once the inflation airbag rushes out of the seam of the seatback, the nylon bag will be filled fast, and will push the passenger to the opposite side of the collision to avoid injury. After the airbag inflates sufficiently, the blowhole in the airbag can prevent pressure rising and avoid hurt due to the sudden impact forces.

Head Side Curtain Airbag Module (if equipped)

When a collision occurs, the head side curtain airbag can ensure that the head of the occupants will not touch the body directly, also prevent the invaded objects from hurting the body of the occupants.

The head side curtain airbag module is fitted inside the inner trim panel of the upper side on the front door and the rear door. The gas generator is secured on the white body of the D pillar upper trim panel. The front drawstring is secured on the lower of A pillar. The airbag is secured with 5 small brackets and 1 deflector to ensure that the airbag will not disengage with the body after inflating. The head side curtain airbag module connects with the **ECU** by wire harness of body.



Operation

General Description

The supplemental restraint system is activated when the key is inserted. When the ignition switch is turned on, the **SRS** warning light will illuminate for approximate 4 seconds and then turn off, this indicates that the system is normal.

Front Collision

When the frontal collision is severe enough, and exceeds the threshold value of **SRS ECU**, the front airbag module and the pretensioner front seat belt will effect.

When the accelerometer and the safing sensor in the **SRS** electronic control unit sense a collision, the electronic control unit will generate current to trigger the front airbag module:

- The front airbag module of the driver side is activated to make the airbag inflate.
- The front airbag module of the passenger side is activated to make the airbag inflate.

After the front airbag inflates sufficiently, the airbag will release gas through the path immediately to provide a gradual deceleration for the passengers moving forward, and by which can reduce the risk of injury of the occupants.

A safing sensor is fitted on the pretensioner of the seat belt, and its acting time is shorter than the front airbag, and thus the occupants will be in their position before the airbag inflates entirely.

SRSECU can estimate the impact results from a rough road or a frontal collision. If the frontal collision that monitored by the sensor is severe enough, the **SRSECU** will send an ignition signal to the airbag module and the seat belt pretensioner.

Side Collision

Whether the seat side airbag and the head curtain airbag operate or not depends on the threshold value, which is triggered by the side collision, in the condition that the severity is beyond the threshold value when side collision occurs. When the **SRSECU** receives the trigger signals from the side impact sensor, the seat side airbag and the curtain airbag module will be activated. The triggered gas generator generates a large amount of gas and makes the airbag inflate. The inflation airbag ejects out from the seat covering, and the head curtain airbag module is triggered, the airbag ejects out from the inner trim panel on the upper side of the door to prevent the head of the occupants from hurting. The redundant gas will release after the airbag inflates sufficiently to reduce the risk of injury of the occupants.

Frontal Collision at an Angle

When a frontal collision at an angle occurs, the airbag and the seat belt pretensioner unit operate or not depending on the

speed and the angle of the collision. There are following several cases:

- The collision below the threshold value of the **SRSECU** impact sensor, no airbag or pretensioner unit of the seat belt is activated.
- If the speed and the angle of the collision are beyond the trigger threshold value of the front impact sensor, the driver and passenger front airbag and the seat belt pretensioner are activated (it's possible that the side airbag detonates).

Inspection of Warning Light

When the ignition switch is turned on, the **SRS** warning light should illuminate, then we can perform the inspection of the light. If the **SRS** has no malfunction, the warning light should be turned off after approximately 4 seconds to monitor the following ignition trip. The system inspection includes the condition of **SRSECU** and **SRS** wiring harness.

Successional Malfunctions of the System

When the ignition switch is turned on, the **SRS** warning light illuminates, and it will illuminate in the following ignition trip if the system has anyone of the following malfunctions:

- **ECU** and **SRS** Malfunction
- Wire Harness Malfunction
- Malfunction in the Connection of the Ground
- Open Circuit Malfunction
- Airbag Module Malfunction
- Seat Belt Pretensioner Malfunction

During driving, if the system monitors a malfunction, the warning light will illuminate to indicate malfunctions in the **SRS** system. When a collision occurs with the warning light illuminating, the **SRS** will not operate.

When the ignition switch is turned on, the diagnostic function of the **SRSECU** is monitoring **SRS**. If it monitors a malfunction, the **SRSECU** stores a related trouble code in the nonvolatile memory and outputs a signal to illuminate the **SRS** warning light. Using the scan tool to read the malfunction message in the memory.

Malfunction of the Low Voltage

When the voltage supplied is not within the specified range, the malfunction light will illuminate. The trouble code is stored in the memory.

Intermittent Problems

At this time the warning light will illuminate and remain on in the following driving cycle. Unless the malfunction occurs in the next ignition, the warning light will not illuminate during the next ignition, but the trouble code is stored in the **SRSECU** memory.

Permanence Malfunction

For the permanence malfunction, the **SRS** light will illuminate with starting test and remain on in each following ignition trip, until the reason of the malfunction is solved. Otherwise, the diagnosis system will record the malfunction messages that occurred.

After discovering the malfunction, the system will keep some operating functions:

- If a malfunction of the **SRSECU** circuit outside **SRS** is detected, the **SRSECU** triggers the airbag and the seat belt pretensioner module.
- When the **SRSECU** or the power supply malfunction is monitored, the entire system will not operate.
- If the circuit of **SRS** warning light is defected, the warning light will not illuminate when performing the initial check

with the ignition switch turned on, if the system has no other malfunctions, when a collision occurs, all the functions of the system are wellequipped.

Using the "scan tool" can obtain the additional information with diagnostic receptacle includes:

- **SRSECU** Trouble Code
- Hardware and Software Version Grade
- Collision Mode Status
- Vehicle Identification Number (**VIN**) Data

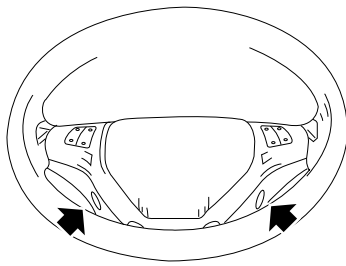
SRSECU recorded the malfunction messages in the memory, the messages are read by the diagnostic socket connected under the instrument panel sealing panel of the driver side by the scan tool.

Service Procedures

Driver Side Airbag

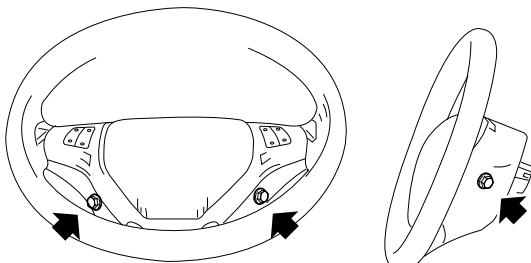
Removal

1. Remove the key from the ignition switch, disconnect the positive and negative of the battery (disconnect the earth lead first). Wait for 10 minutes, the operation can be started after the **SRS** stand-by circuit discharging completely.
2. Remove the steering pad.



S134011

3. Unscrew 2 screws securing the front airbag module to the steering wheel.



S134012

4. Disconnect the connector from the airbag module.
5. Remove the front driver side airbag module.

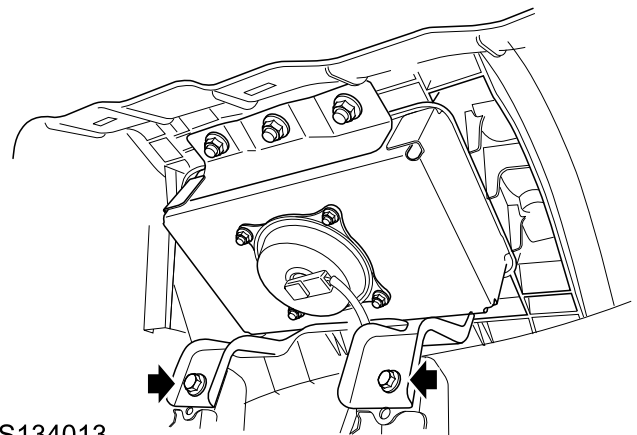
Refit

1. Secure the airbag module to the steering wheel, and connect the connector.
2. Secure the airbag module to the steering wheel, fit the screw and tighten to **10-15 Nm**.
3. Cover the steering cover.
4. Connect the battery negative terminal.
5. Perform system inspection, turn the ignition switch, check if the **SRS** warning light illuminates for 4 seconds, and then turns off.

Passenger Side Front Airbag

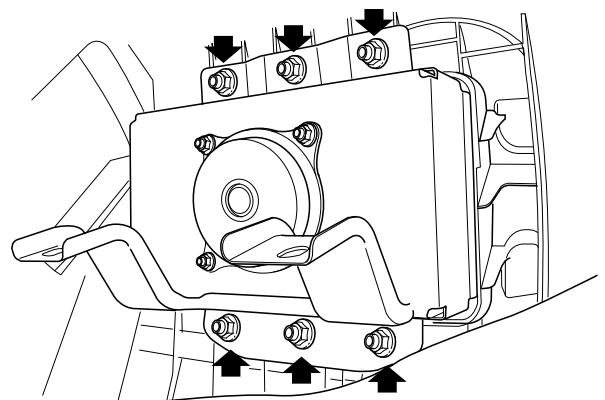
Removal

1. Remove the key from the ignition switch, disconnect the positive and negative of the battery (disconnect the earth lead first). Wait for 10 minutes, the operation can be started after the **SRS** stand-by circuit discharging completely.
2. Remove the instrument panel assembly.
3. Disconnect the connector from the airbag module.
4. Unscrew 2 screws securing the front passenger side front airbag module support to the instrument panel support.



S134013

5. Unscrew 6 nuts securing the passenger side front airbag module to the instrument panel, remove the airbag module.



S134014

Refit

1. Secure the passenger side front airbag module to the instrument panel, fit the screw and tighten to **4.5-5.5 Nm**.
2. Secure the passenger side airbag module support to the instrument panel support, fit the screw and tighten to 6-8 Nm.
3. Connect the connector to the airbag module.
4. Fit the instrument panel assembly.

5. Connect the battery negative terminal.
6. Turn the ignition switch on and check if the **SRS** warning light illuminates for 4 seconds, and then turns off.

Side Curtain Airbag

Removal

1. Turn the ignition switch on, check if the **SRS** warning light illuminates for 4 seconds, and then turns off.
2. Remove the A pillar trim panel, the B and C pillar upper trim panel and the D pillar trim panel.

 **A Pillar Upper Trim Panel**

 **A Pillar Lower Trim Panel**

 **B Pillar Upper Trim Panel**

 **C Pillar Trim Panel**

3. Remove the roof interior.

 **Roof Interior**

4. Disconnect the electrical connector.
5. Unscrew 2 screws and 2 screw strikers securing the side curtain airbag bracket to the body.
6. Unscrew 5 bolts securing the side curtain airbag to the body.
7. Remove 5 snap fits securing the side curtain airbag into the appropriate mounting holes.
8. Unscrew the tree type screw placing the lead clamp into the appropriate hole of the A pillar.
9. Disconnect the interface between the side curtain airbag wire of the vehicle harness and the gas generator.
10. Unscrew 2 bolts securing the B pillar deflector of the side curtain airbag to the upper side of B pillar.
11. Unscrew 2 bolts securing the gas generator bracket to the white body.

Refit

1. Secure the gas generator bracket to the white body, fit the bolt and tighten to 3-5 Nm.
2. Secure the B pillar deflector of the side curtain airbag to the upper side of B pillar, fit the bolt and tighten to 3-5 Nm.
3. Connect the interface between the side curtain airbag wire of the vehicle harness and the gas generator together.
4. Position the lead clamp into the appropriate hole of the A pillar, and secure it with the tree type screw.
5. Stick the snap fit of the side curtain airbag in the appropriate mounting holes.
6. Secure the side curtain airbag to the body, and fit the bolt and tighten to 3-5 Nm.
7. Secure the side curtain airbag to the body, and fit the bolt and tighten to 3-5 Nm.
8. Connect the electrical connector.
9. Fit the roof interior.

 **Roof Interior**

10. Fit the A pillar trim panel, the upper B and C pillar trim panel.

 **A Pillar Upper Trim Panel**

 **A Pillar Lower Trim Panel**

 **B Pillar Upper Trim Panel**

 **C Pillar Trim Panel**

11. Connect the battery negative terminal.

Front Seat Belt Pretensioner**Removal****Refit**

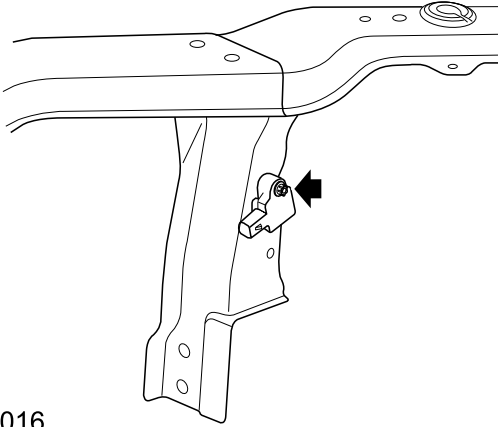
Front Impact Sensor

Removal

1. Remove the front bumper.

Front Bumper

2. Remove a bolt securing the front impact sensor assembly to the front bumper bracket.



S134016

3. Disconnect the electrical connector.
4. Remove the front impact sensor.

Refit

1. Secure the front impact sensor assembly to the front bumper bracket, fit the bolt and tighten to **7-9 Nm**.
2. Connect the electrical connector.
3. Fit the front bumper.

Front Bumper

Side Impact Sensor

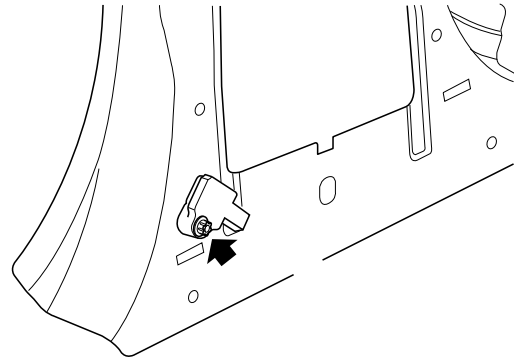
Removal

1. Remove the B and C pillar lower trim panel.

B Pillar Lower Trim Panel

C Pillar Trim Panel

2. Unscrew a bolt securing the side airbag sensor assembly to the B and C pillar lower trim panel.



S134017

3. Disconnect the electrical connector.
4. Remove the side airbag sensor.

Refit

1. Secure the side airbag sensor assembly to the B pillar, fit the bolt and tighten to **7-9 Nm**.
2. Connect the electrical connector.
3. Fit the B and C pillar lower trim panel to the original place.

B Pillar Lower Trim Panel

C Pillar Trim Panel

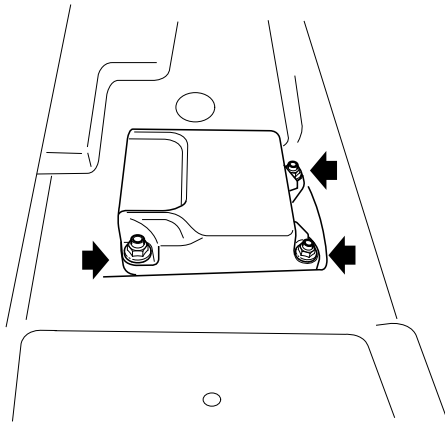
Supplemental Restraint System Diagnostic and Control Unit

Removal

1. Remove the key from the ignition switch, disconnect the positive and negative of the battery (disconnect the earth lead first). Wait for 10 minutes, the operation can be started after the **SRS** stand-by circuit discharging completely.
2. Remove the centre console.

Centre Console

3. Release the shift mechanism, put it aside.
4. Disconnect the connector
5. Unscrew 3 nuts securing the supplemental restraint system diagnostic and control unit to the body.



S134018

6. Remove the protection equipment diagnostic and control unit.

Refit

1. Connect the electrical connector.
2. Secure the supplemental restraint system diagnostic and control unit to the body, fit the nut and tighten to 8 Nm.
3. Fit the shift mechanism to the original place.
4. Fit the centre console to the original place.

Centre Console

5. Perform system inspection, turn the ignition switch, check if the **SRS** warning light illuminates for 4 seconds, and then turns off.

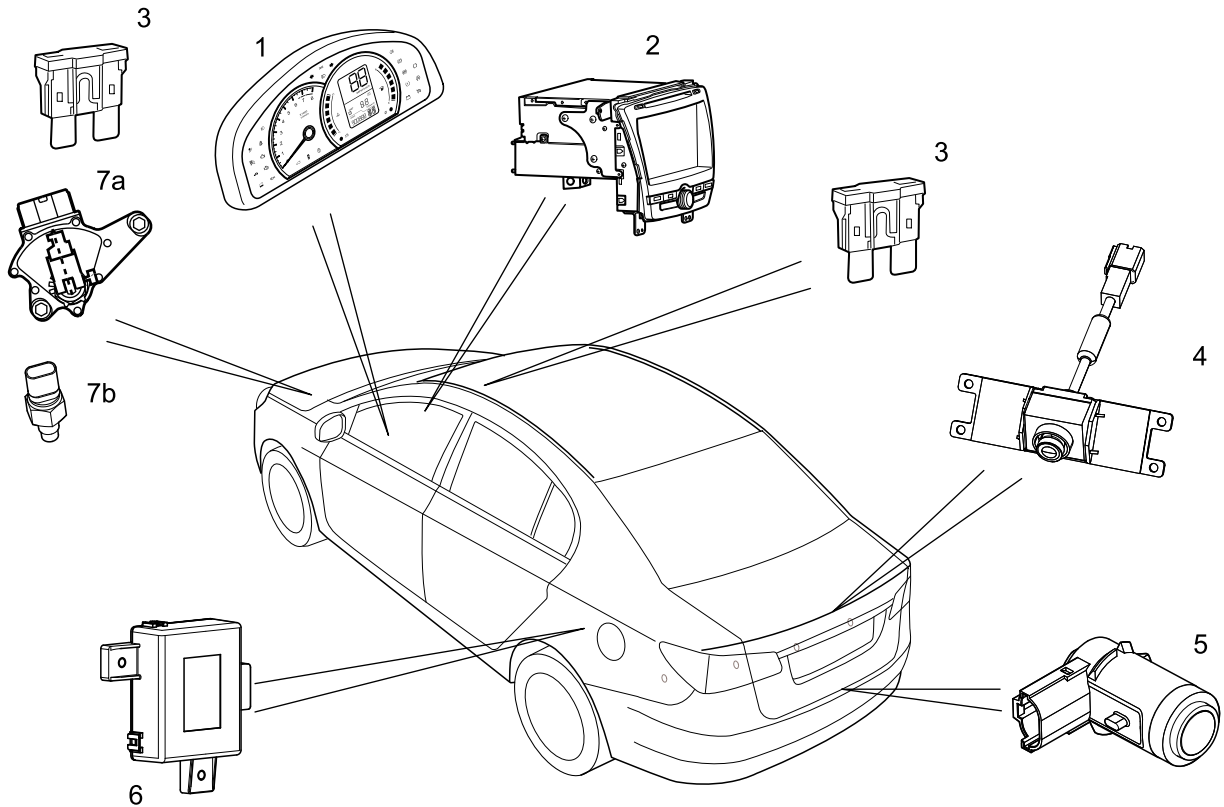
Park Assistant System**Specifications****Torque**

| Description | Value |
|--------------------------------------|----------|
| Bolt - Parking Assist Control Unit | 4-6 Nm |
| Bolt - Rear License Plate Trim Panel | 2-2.5 Nm |

Description and Operation

System Component Layout

Parking Assist System Component Layout

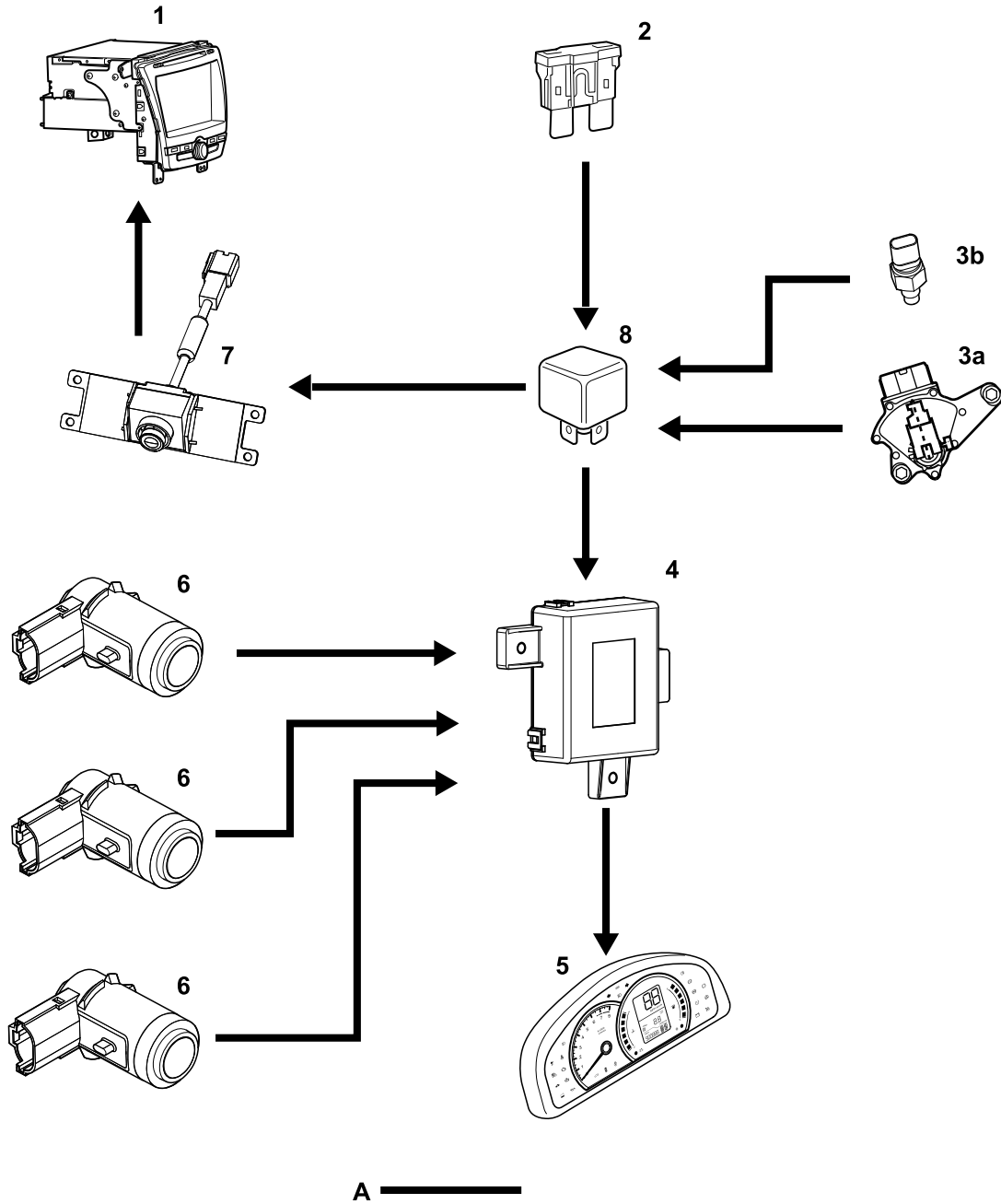


S822004

- | | |
|---|---|
| <ul style="list-style-type: none"> 1. Instrument Pack (Alarm Unit with Sound) 2. Navigation Display Unit 3. Engine Compartment Fuse EF7 4. Rear Camera (if equipped) 5. Rear Ultrasonic Sensor | <ul style="list-style-type: none"> 6. Parking Distance Control Unit 7. a Neutral Start Switch (for Automatic Transmission) b Back-Up Light Switch (for Manual Transmission) |
|---|---|

System Control Diagram

Parking Assist System Control Diagram



A = Hard Wire

- | | |
|--|--|
| 1. Navigation Display Unit | 4. Parking Distance Control Unit |
| 2. Engine Compartment Fuse EF7 | 5. Instrument Pack (Alarm Unit with Sound) |
| 3. a Neutral Start Switch (for Automatic Transmission) | 6. Rear Ultrasonic Sensor |
| b Back-Up Light Switch (for Manual Transmission) | 7. Rear Camera (if equipped) |

Description

General Description

While reversing, if there is an obstacle on the reversing route, the parking distance control system will give a warning to the driver. The system consists of 3 ultrasonic sensors fitted on the rear bumper, the **PDCECU** and the sound alarm unit in the instrument pack. When the vehicle drives in reverse, the **PDCECU** uses the ultrasonic sensor to monitor the area around the rear bumper, if an object is detected in the area, the sound alarm unit in the instrument pack will sound. The system can detect not only the harder solid obstacle, but also the object such as the iron fence.

If fitting the rear camera, the image of the vehicle rear area will be displayed on the navigation display.

Ultrasonic Sensor

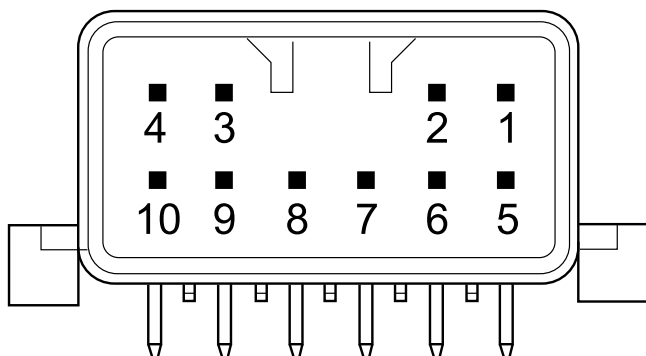
The ultrasonic sensor is fixed on the rear bumper. The structures of all 3 sensors are the same, and the colour matches with the main body.

The detection area of the centre sensor is 1200 mm away from the vehicle rear bumper, and the detection range of the 2 side sensors is 600 mm away from the bumper corner.

Parking Distance Control Unit (PDC ECU)

PDCECU provides the system with the automatic control function without the interference of the driver. **ECU** is behind the left side of the boot trim panel. There is a connector between the **ECU** and the vehicle wire harness. **ECU** is powered by the engine compartment fuse. When the system is in the activation status, the **ECU** outputs the signal which is modulated well to the ultrasonic sensor and the speaker, and receives the distance reading input information from the sensor.

View of ECU Wire Harness Connector End



Connector Pin Detailed Information Chart

| Pin No. | Description |
|---------|--|
| 1 | Rear Sensor LH Power Source/Send/Receive Signal Pin |
| 2 | Postmedial Sensor Power Source/Send/Receive Signal Pin |

| | |
|----|---|
| 3 | No Connection |
| 4 | Signal Ground |
| 5 | No Connection |
| 6 | Rear Sensor RH Power Source/Send/Receive Signal Pin |
| 7 | No Connection |
| 8 | Alarm Signal Output Pin |
| 9 | Power Source Ground |
| 10 | Power Supply (Back-up Light Power Source) |

Sound Alarm Unit

The sound alarm unit in the instrument pack can sound the alarm to inform the driver of the system status and the obstacle condition in the monitor area.

Rear Camera (if equipped)

The rear camera is fitted on the trim panel over the rear license plate, and provides the driver with the rear real-time image to help reverse. The video output end (2 pins) of the rear camera is connected to the navigation unit through the hard wire, the end is connected to the battery through the back-up light switch, the other end grounds directly.

When switching to "R" gear, supply this system with a 12 VDC power source, the system will start to work, meanwhile, the display changes to the working condition of the system to display the obstacle behind the vehicle. The obstacle behind the vehicle is detected and displayed by the camera, the appropriate signal is sent to the imagery control module, and the module processes it and transmits it to the **DVD** for imaging, which can help the driver to reverse.

The light irradiates the object, the light on the object by the optical image generated by the lens focus reflects to the surface of the image sensor, and generates the photoelectricity action, and then it is converted into the electric signal, and changes the image signal through corresponding conversion, the signal is sent into the image signal process chip to process, and outputs the video signal.

View of Rear Camera Connector End

| Pin No. | Description |
|---------|---------------------|
| 1 | Power Source 12 V |
| 2 | Power Source Ground |
| 3 | Video Signal |
| 4 | Signal Ground |

Precaution for Parking Assist System

Check for the person or animal is in the surrounding when reversing. Pay close attention to the child. When can not confirm in the vehicle, please exit the vehicle to confirm.

1. The parking assist system is a assist system which is designed to faciliate the driver.
2. The driver should pay attention to any possible condition which will occur.
3. The sensor is easily damaged when the sensor location in the bumper is subjected to the impact or higher pressure, or the sensor location is subjected to the impact of higher water pressure when washing the vehicle.
4. The system is normal, the transmission lever is switched to "R" when the ignition switch is ON, a short "beep, beep" from the system will sound.

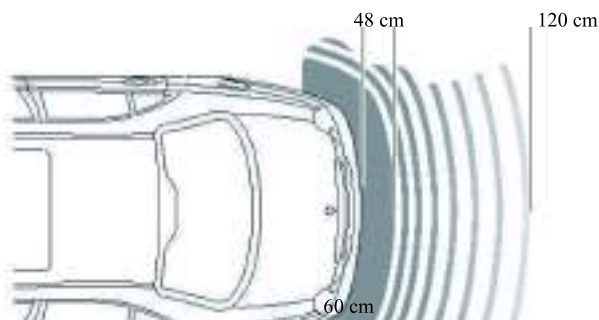
Operation

General Description

When the ignition switch is in position II and selects reverse, the system will operate. After **ECU** selects reverse, the system is activated with delaying for 1 second. In the automatic transmission models, after the **ECU** receiving the reverse selection information, it starts the ultrasonic sensor, and then outputs the signals to the speaker, a separate alarm ("beep, beep") will be heard from the speaker to indicate that the system is in the activated status. Then the **ECU** receives the distance reading information from the ultrasonic sensor, and determines if there is any object in the detection range. If there's no object in the detection range, DO NOT sound any alarm that can be heard, if any object is detected, the **ECU** will send signals to the speaker, which generate a repeating audible alarm. Starting from the edge of the detection range (approximately 1200 mm away from the rear of the vehicle), the frequency of the alarm increases with the distance between the object and the vehicle is shortened, the audible alarm becomes a continuous alarm until the object is away from the vehicle approximately 480 mm. After objects are detected, if the distance between the object and the vehicle does not decrease (for example, the vehicle is stopped, or a rear corner of the vehicle moves along the object in parallel), the alarm will stop after approximately 3 seconds.

If a draw bar is fitted, the pintle hook/pintle ball joint is detected in the input information of the sensor by the **ECU** to connect with the pintle hook/ draft ball on the vehicle, when the shift lever moves between the forward and park position, the system is delayed to avoid emitting the useless alarm.

Detection Area



The relations between the alarm that emitted and the distance of the obstacle are shown in the table below:

| Period | Distance (mm) | Alarm Cycle (msec) |
|--------|---------------|--|
| 1 | 250-480 | OFF ON |
| 2 | 480-660 | OFF ON 65ms 65ms 65ms 65ms 65ms 65ms |
| 3 | 660-840 | OFF ON 65ms 97ms 65ms 97ms 65ms 97ms 65ms |
| 4 | 840-920 | OFF ON 65ms 130ms 65ms 130ms 65ms 130ms 65ms |
| 5 | 920-1200 | OFF ON 65ms 162ms 65ms 162ms 65ms |

Caution: The blind area where the sensor cannot detect obstruction may occur if the distance between the obstruction and the sensor is about 200 mm.

Self-Diagnosis

Every time the system is activated, the **PDCECU** and the sensor perform self test procedure. **PDCECU** inspects short or open of the system circuit. If detecting a malfunction and last for more than 3 seconds, the **PDCECU** will sound high frequency alarm for 3 seconds and a single or multiple alarms, rather than sound the normal prompt when the system is activated for the first time.

| Trouble Mode | Alarm Cycle | Alarm |
|---------------------|-------------|--|
| Left Sensor | T1 T2 T3 | Alarm for 3 seconds "beep" |
| Centre Sensor | | Alarm for 3 seconds "beep, beep" |
| Right Sensor | | Alarm for 3 seconds "beep, beep, beep" |
| More than 2 sensors | | Alarm for 3 seconds "beep——" |

Service Procedures

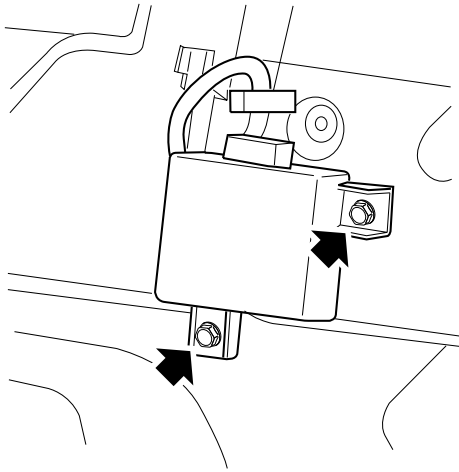
Parking Assist Unit

Removal

1. Remove the boot inner trim panel LH.

 **Boot Inner Trim Panel LH**

2. Disconnect the parking assist unit upper connector.
3. Unscrew 2 bolts securing the parking assist unit to the body side inner panel LH, remove the parking assist unit.



Refit

1. Secure the parking assist unit to the body side inner panel LH, fit the 2 bolts and tighten to **4-6 Nm**.
2. Connect the connector of the parking assist unit.
3. Fit the boot inner trim panel LH.

 **Boot Inner Trim Panel LH**

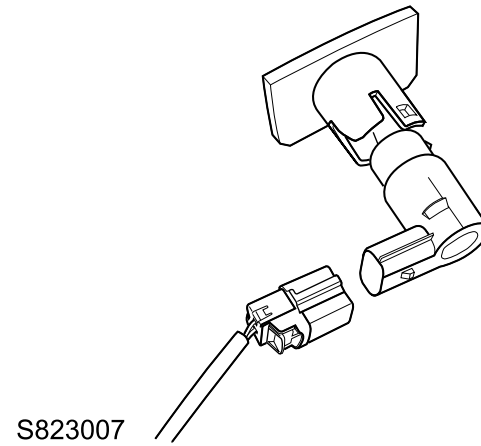
Back Up Sensor

Removal

1. Remove the rear bumper.

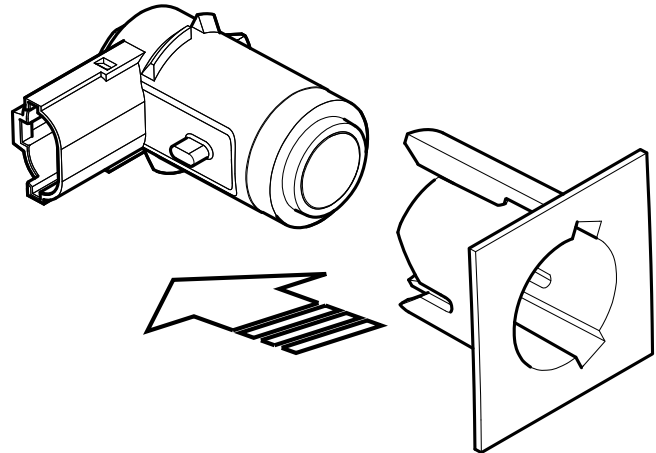
 **Rear Bumper**

2. Disconnect the connector of the back up sensor.



S823007

3. Remove the back up sensor from the back up sensor mount support.



Refit

1. Secure the back up sensor to the back up sensor support.
2. Connect the back up sensor connector.
3. Fit the rear bumper.

 **Rear Bumper**

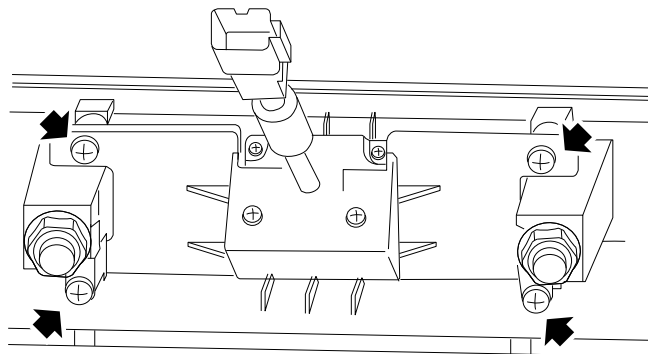
Rear Camera

Removal

1. Remove the rear license plate trim panel.

Rear License Plate Trim Panel

2. Loosen the rear camera connector.
3. Remove 4 bolts securing the rear camera to the rear license plate trim panel.



Refit

1. Secure the rear camera to the rear license plate trim panel, fit the 4 set bolts and tighten to **2-2.5 Nm**.
2. Connect the connector of the rear camera.
3. Fit the rear license plate trim panel.

Rear License Plate Trim Panel

Entertainment and Navigation

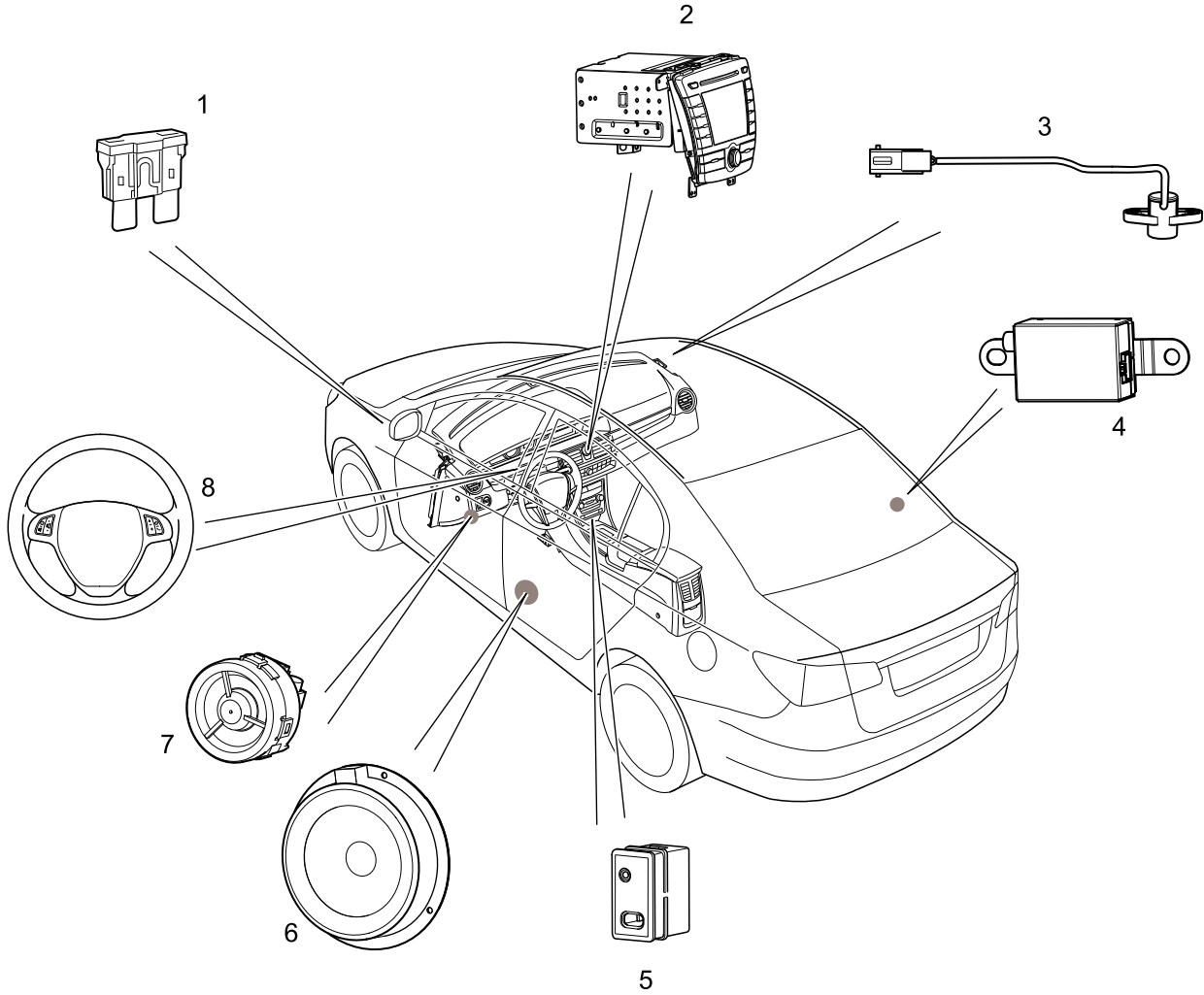
Specifications

Torque

Description and Operation

System Component Layout

CD Player Component Layout



1. Engine Bay Fuse EF9

2. CD Player

3. Microphone

4. Antenna Amplifier

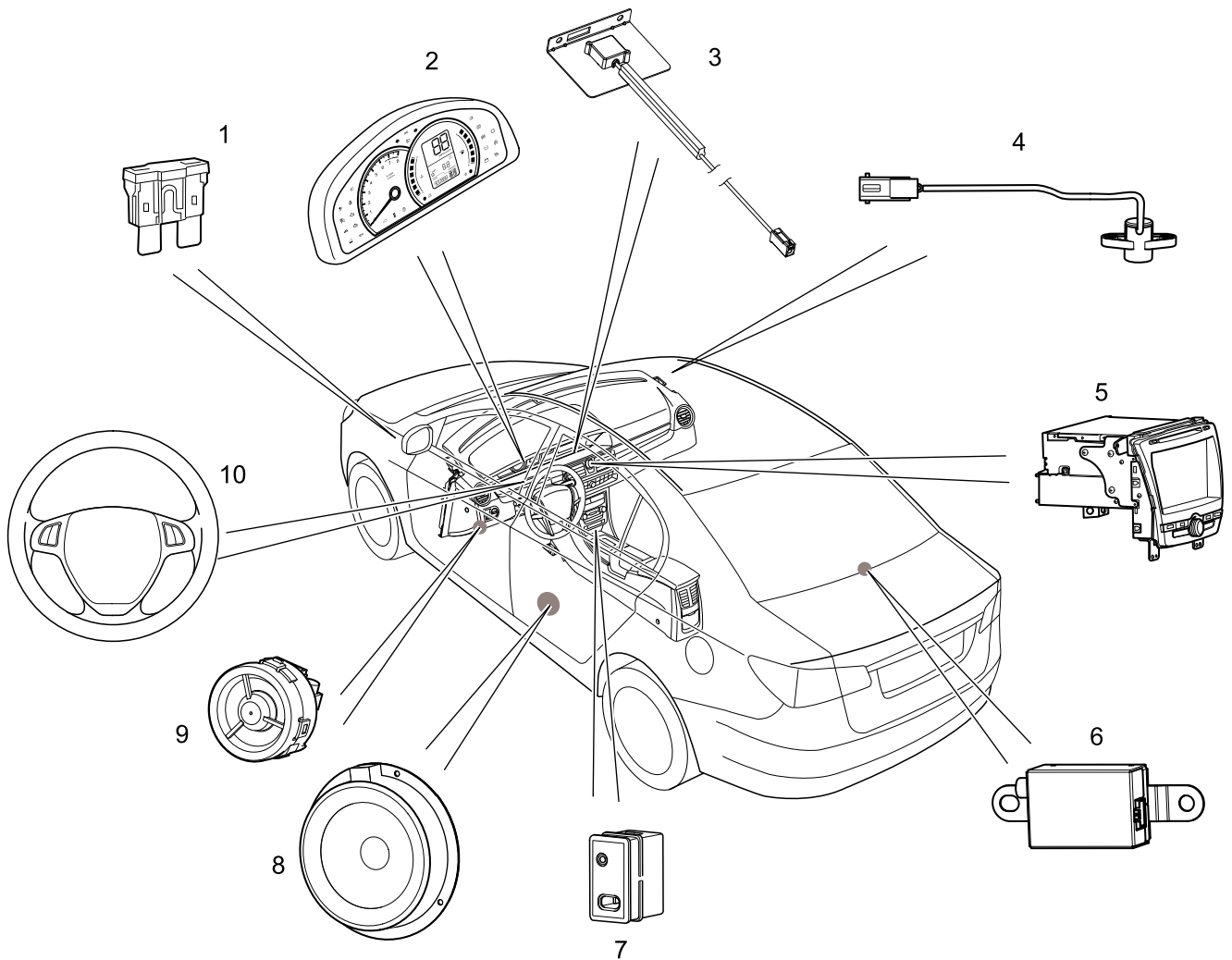
5. USB/AUX Port

6. Woofer

7. Tweeter

8. Steering Wheel Entertainment Control Switch

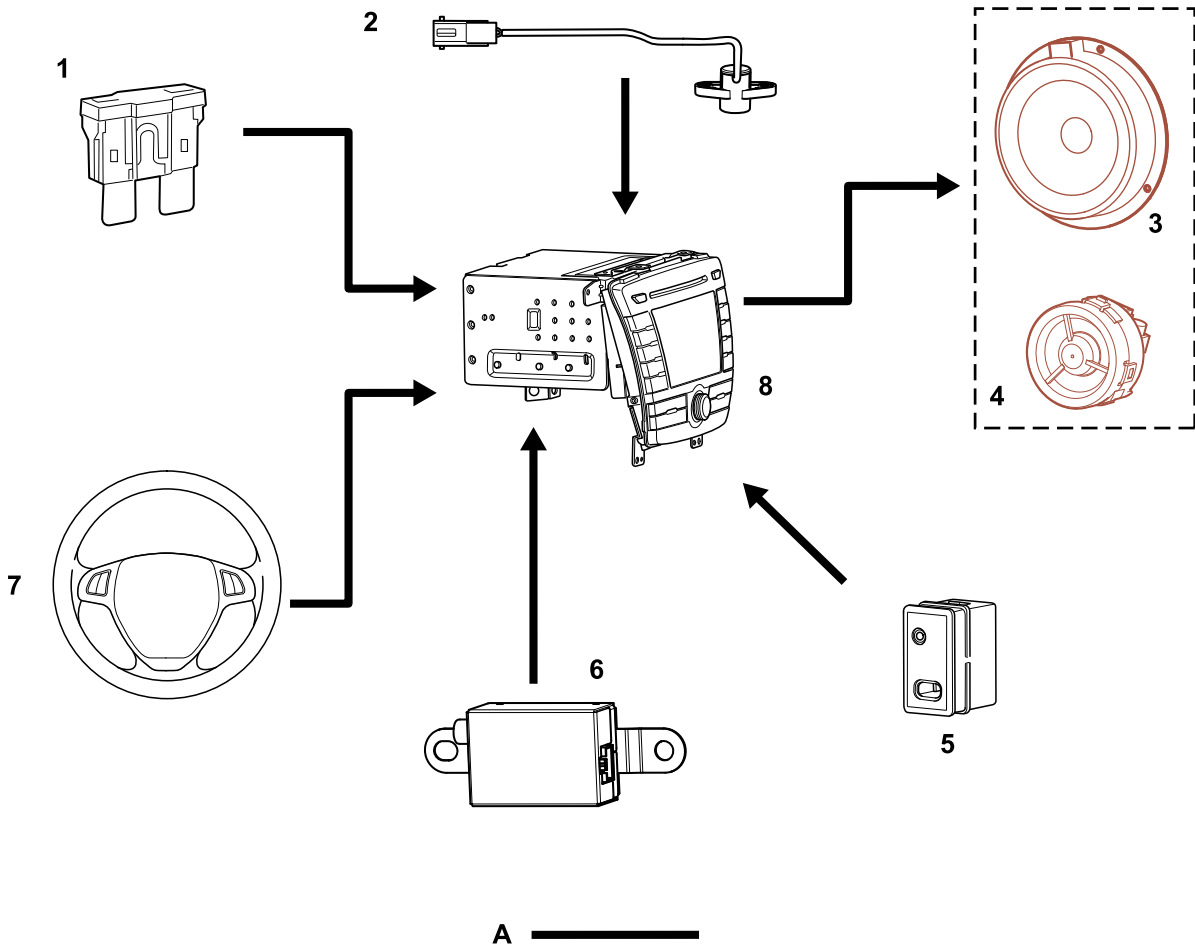
Navigation System Component Layout



- 1. Engine Bay Fuse EF9
- 2. Instrument Pack
- 3. Navigation Antenna
- 4. Microphone
- 5. Navigation Display Unit

- 6. Antenna Amplifier
- 7. USB/AUX Port
- 8. Woofer
- 9. Tweeter
- 10. Steering Wheel Entertainment Control Switch

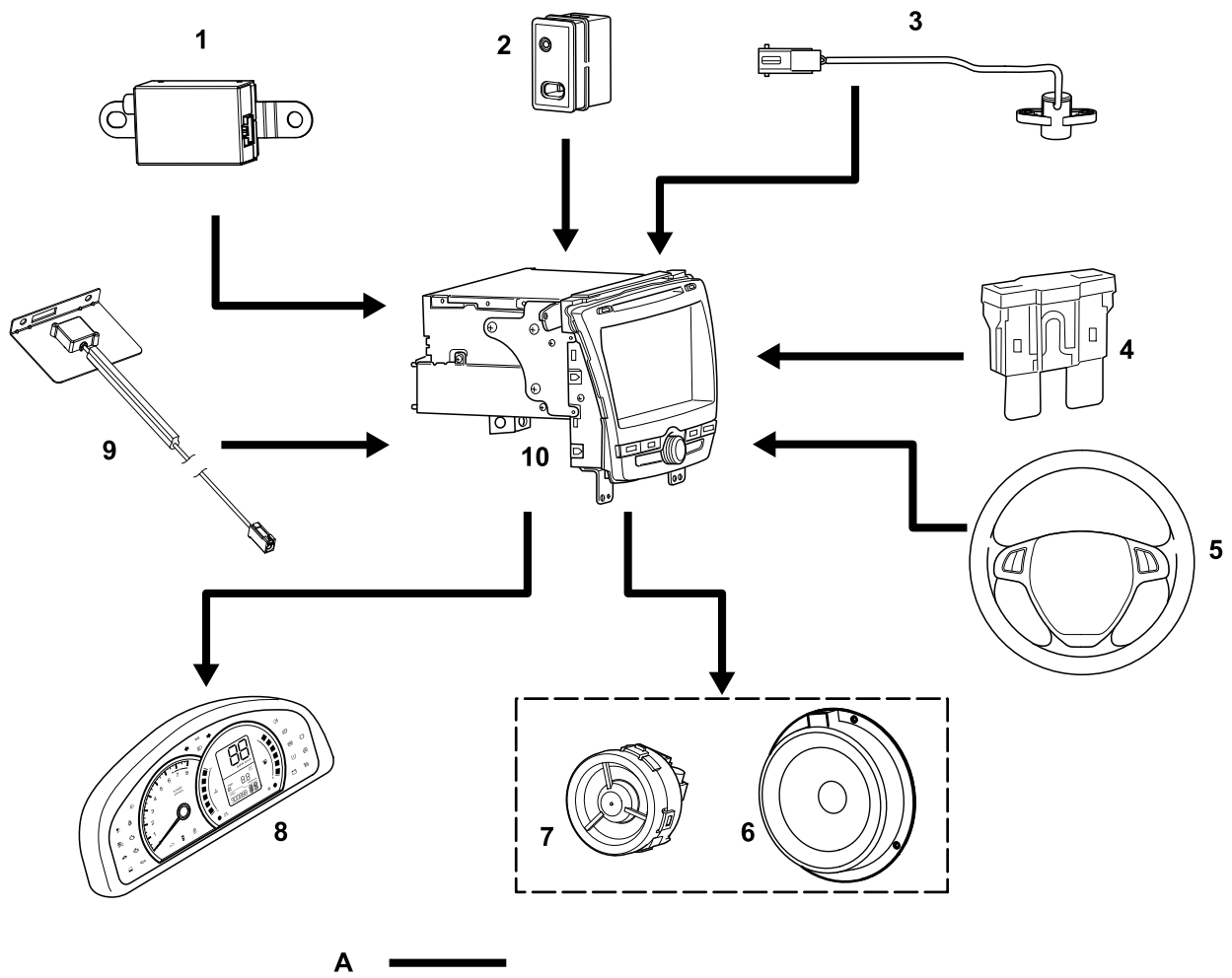
System Control Diagram
CD Player Control Diagram



A = Hard Wire

- 1. Engine Bay Fuse EF9
- 2. Microphone
- 3. Woofer
- 4. Tweeter
- 5. USB/AUX Port
- 6. Antenna Amplifier
- 7. Steering Wheel Entertainment Control Switch
- 8. CD Player

Navigation System Control Diagram



A = Hard Wire

- | | |
|--|-----------------------------|
| 1. Antenna Amplifier | 6. Woofer |
| 2. USB/AUX Port | 7. Tweeter |
| 3. Microphone | 8. Instrument Pack |
| 4. Engine Bay Fuse EF9 | 9. Navigation Antenna |
| 5. Steering Wheel Entertainment Control Switch | 10. Navigation Display Unit |

Description

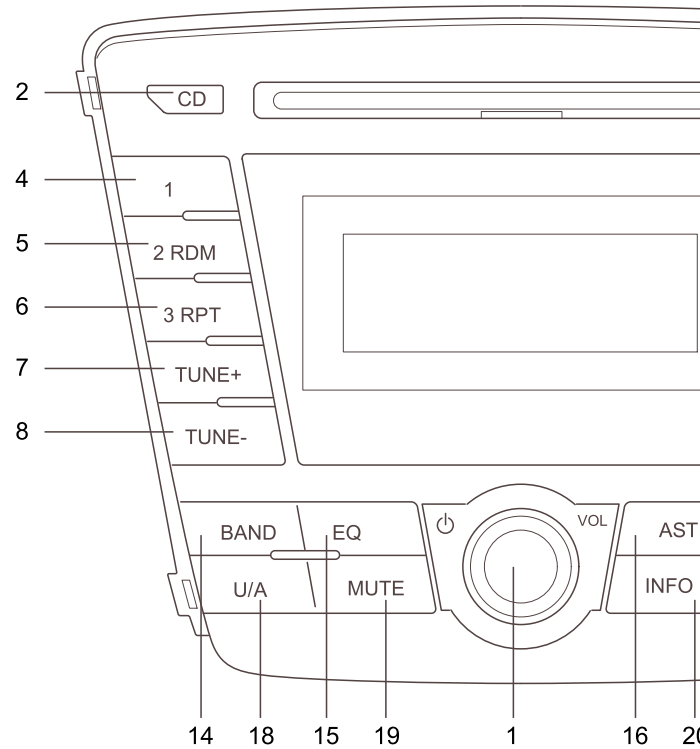
General Description

Based on the vehicle configuration and the assemble option, four kinds of audio head units are available for refit:



1. Radio, CD player, monochrome display, USB /**AUX** port.
2. Radio, virtual CD player, monochrome display, USB /**AUX** port, Bluetooth phone.
3. Radio, CD/DVD player, color display, USB /**AUX** port, Bluetooth phone, satellite navigation.
4. Communication and navigation system (option).

The navigation system has the function similar to the DVD player, and also the navigation function, and the communication and navigation system supports Internet access.

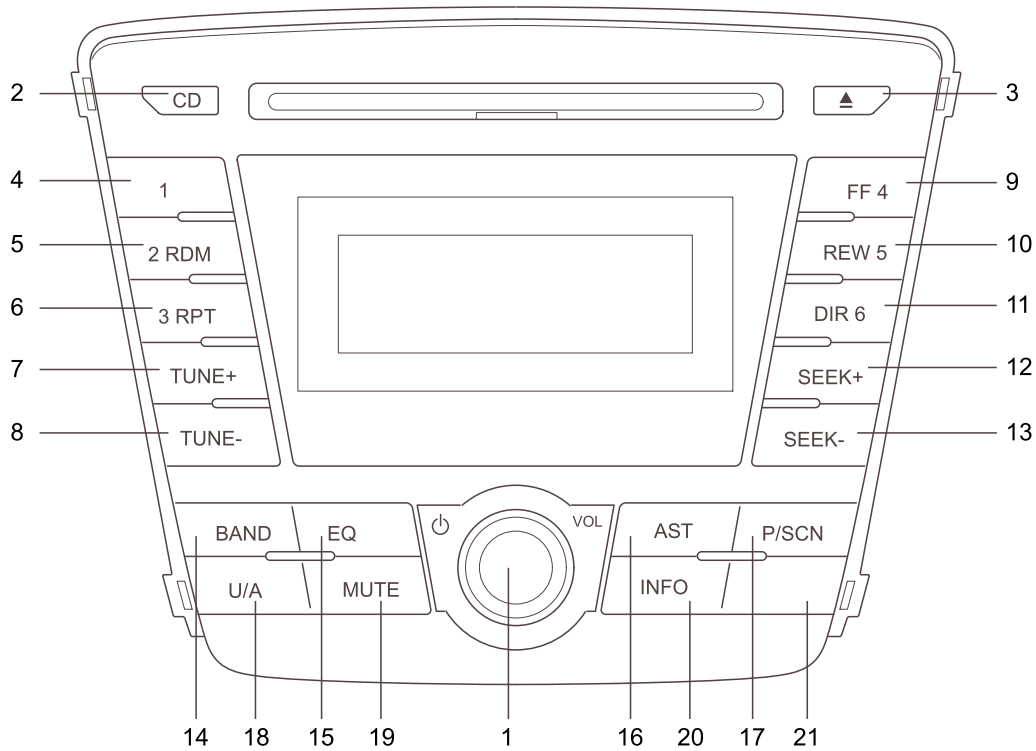
Single CD Radio and Player



S141001

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. [POWER]/[VOL] Power/Volume Adjustment 2. [CD] CD/MP3/WMA Mode Change 3.  Eject 4. [1] Frequency Band 1 5. [2 RDM] Frequency Band 2/Random Play 6. [3 RPT] Frequency Band 3/Repeat Play 7. [TUNE+] Increase Frequency Modulation 8. [TUNE-] Decrease Frequency Modulation 9. [FF 4] Frequency Band 4/Fast Forward 10. [REW 5] Frequency Band 5/Fast Rewind 11. [DIR 6] Frequency Band 6/Repeat Play | <ol style="list-style-type: none"> 12. [SEEK+] Select Last Folder 13. [SEEK-] Select Next Folder 14. [BAND] Select Radio Mode 15. [EQ] Select Sound Effect Mode 16. [AST] Auto Search 17. [P/SCN] Scan Frequency Modulation 18. [U/A] Select USB/AUX Mode 19. [MUTE] Mute 20. [INFO] Song Information Display 21.  Clock Setting Mode |
|--|--|

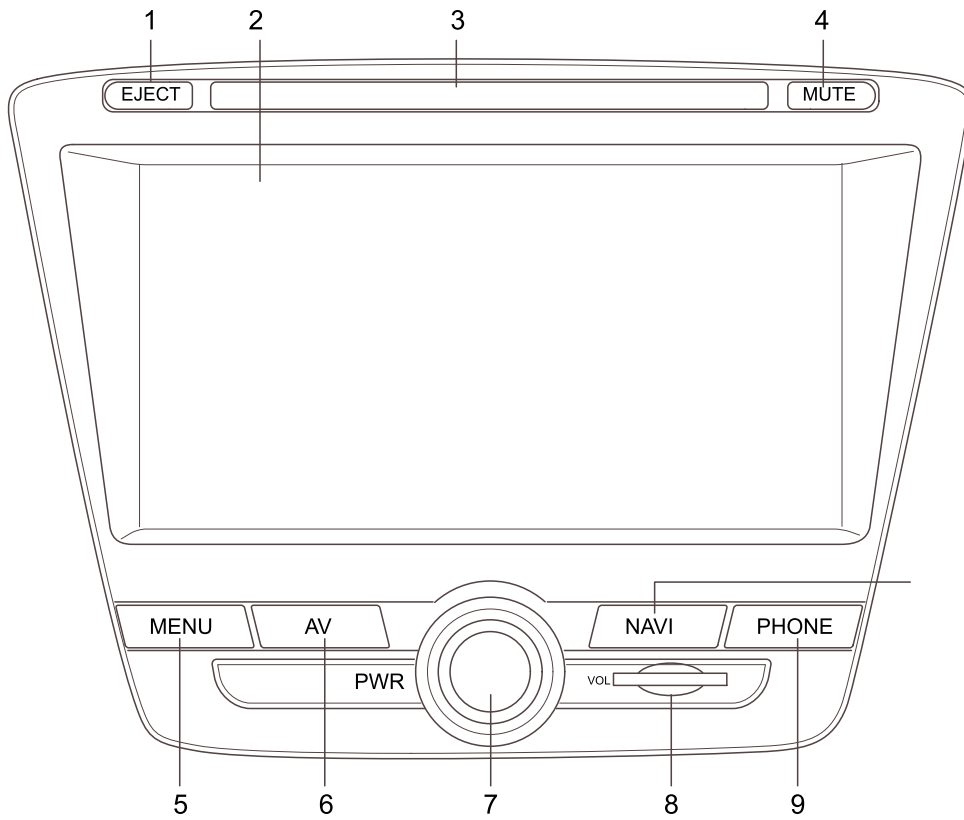
6-CD Radio and Player



S141002

- | | |
|--|---|
| <ul style="list-style-type: none"> 1. [POWER]/[VOL] Power/Volume Adjustment 2. [SRCE] Select Mode 3. [Eject] Eject 4. [1 REC] Frequency Band 1/Virtual Memory 5. [2 RDM] Frequency Band 2/Random Play 6. [3 RPT] Frequency Band 3/Repeat Play 7. [TUNE+] Increase Frequency Modulation 8. [TUNE-] Decrease Frequency Modulation 9. [FF 4] Frequency Band 4/Fast Forward 10. [REW 5] Frequency Band 5/Fast Rewind 11. [DIR 6] Frequency Band 6/Repeat Play | <ul style="list-style-type: none"> 12. [SEEK+] Select Last Folder 13. [SEEK-] Select Next Folder 14. [BAND] Select Radio Mode 15. [EQ][EQ Select Sound Effect Mode] 16. [AST] Auto Search 17. [P/SCN] Scan Frequency Modulation 18. [Bluetooth Phone] Bluetooth Phone 19. [MUTE] Mute 20. [INFO] Song Information Display 21. [Enter Key] Enter Key |
|--|---|

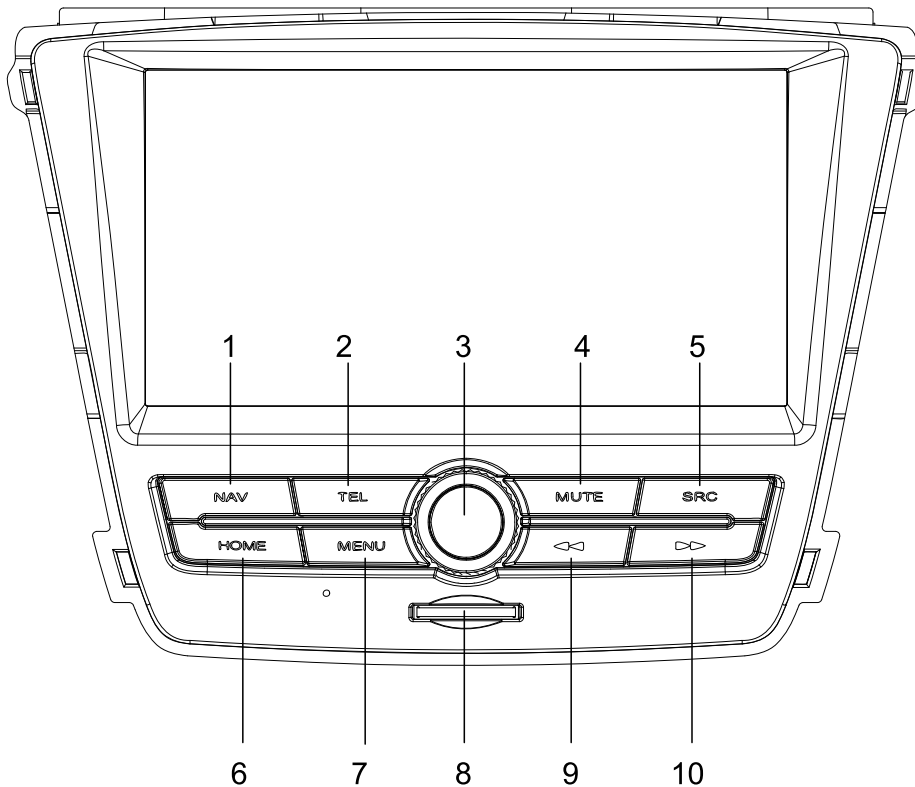
Navigation System



S141003

- 1. Eject Button
- 2. Display
- 3. Disc Loading Slot
- 4. Mute Button
- 5. Menu Button
- 6. AV Button
- 7. Volume Adjustment Knob
- 8. SD Card Slot
- 9. Phone Button
- 10. Navigation Button

Communication and Navigation System

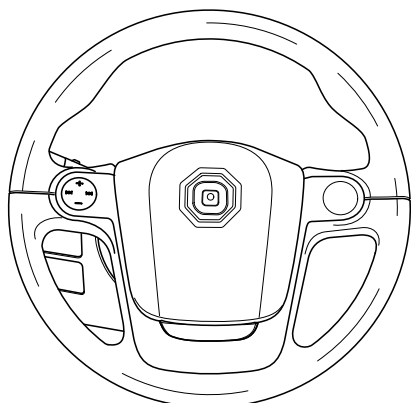


S141030

- 1. Eject Button
- 2. Display
- 3. Disc Loading Slot
- 4. Mute Button
- 5. Menu Button
- 6. AV Button
- 7. Volume Adjustment Knob
- 8. SD Card Slot
- 9. Phone Button
- 10. Navigation Button

Audio Control Buttons on Steering Wheel

The audio device can be controlled by the remote switch fitted on the steering wheel. These function buttons make the use of the most common function in the ICE system more convenient.

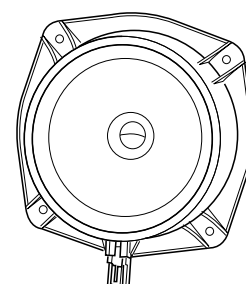


Display

The audio information and related information are displayed on the display.

Woofers

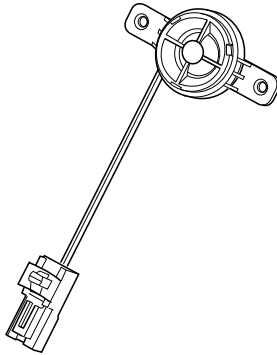
The woofers are fitted in the four doors. They are secured to the door panel with 4 screws.



S141006

Tweeter

The tweeters are fitted in the four doors. They are secured to the door panel with 2 screws.



S141007

Radio Antenna

The antenna signal is received through the **HRW** element in the rear windshield. The antenna amplifier is located on the "D" pillar RH.

GPS Antenna

GPS antenna is located behind the front instrument panel above the instrument pack. The antenna is connected to the **GPS** receiver through a separate coaxial cable, and it sends signal received from **GPS** satellite to the receiver for processing.

When the satellite is at the areas of hills or thick woods, high buildings, multi-story parking spaces, garages, tunnels, bridges and encounters the heavy rain/thunder storm, the antenna may lose the signal. If the signal is lost, the navigation computer will carry on navigation using the stored map information until the signal resumes.

GPS

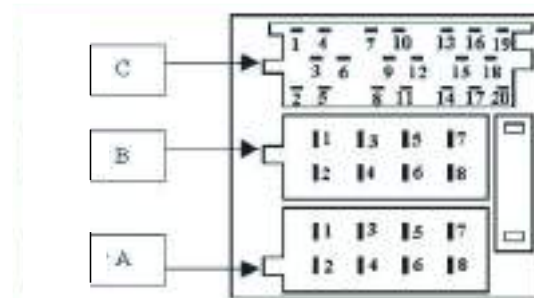
The navigation system can provide the route guidance information acoustically and visually, to direct the driver to the intended destination. This system allows the driver to set the route using the general road or highway. And it can also help the driver obtain the direction of the points of interest, such as the hospital, museum, monument and hotel, etc. The navigation computer can determine the optimum route of travel and provide the driver with the detailed information of the direction and nearby crossing using the map information stored in the SD memory card.

The current position of the vehicle is determined by the global positioning system (**GPS**). The satellite used by the **GPS** runs in the high altitude orbit which is about 20000 km above the earth's surface, rotates around the earth one revolution every 12 hours, and provides the information about the satellite position, such as the latitude, longitude, altitude, almanac data

and time, etc. The almanac data is the current condition of the satellite running around the earth orbit. The computer determines which satellite is visible to the system, the current positions of these satellites and the relationship between them. With the information, the computer can describe the satellite position deviation and compensate for the deviation to improve the accuracy of the navigation system. Almanac data from at least four different satellites is needed for the navigation system to calculate the three-dimensional position of the vehicle. As the vehicle drives, the computer continuously updates the information so that it can continue to identify the accurate position of the vehicle. The vehicle direction is determined by the navigation computer with the measured wheel speed difference.

In Car Entertainment Wire Connector

CD Connector End View



S141008

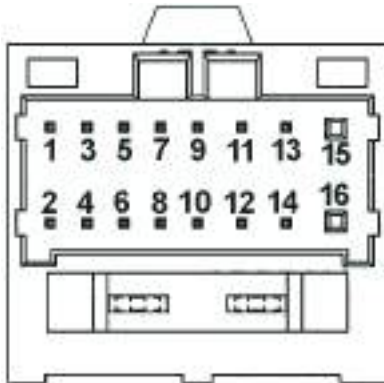
Connector Pin Detailed Information Chart

| Pin No. | Description |
|---------|---------------------------|
| A1 | Vehicle Speed Signal |
| A2 | Reserve |
| A3 | No Connection |
| A4 | Ignition Switch (ACC/IGN) |
| A5 | Antenna Power Supply |
| A6 | Back Light Illumination |
| A7 | Power Source |
| A8 | Power Ground |
| B1 | Rear Speaker Positive RH |
| B2 | Rear Speaker Negative RH |
| B3 | Front Speaker Positive RH |
| B4 | Front Speaker Negative RH |
| B5 | Front Speaker Positive LH |
| B6 | Front Speaker Negative LH |
| B7 | Rear Speaker Positive LH |
| B8 | Rear Speaker Negative LH |

Entertainment and Navigation

| | |
|-----|--|
| C1 | No Connection |
| C2 | Reserve |
| C3 | Reserve |
| C4 | No Connection |
| C5 | Steering Wheel Switch Positive |
| C6 | Steering Wheel Switch Negative |
| C7 | AUX Connected with Positive Tester Probe |
| C8 | AUX Connected with Negative Tester Probe |
| C9 | No Connection |
| C10 | AUX Sound Track RH |
| C11 | AUX Sound Track LH |
| C12 | AUX Ground |
| C13 | Reverse Signal |
| C14 | No Connection |
| C15 | Microphone Positive |
| C16 | Microphone Negative |
| C17 | USB Ground |
| C18 | USB Power Supply |
| C19 | USB Positive |
| C20 | USB Negative |

Navigation Connector End View



S141009

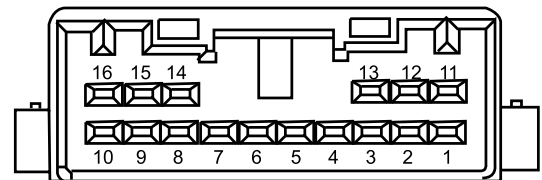
Connector Pin Detailed Information Chart

| Pin No. | Description |
|---------|---------------------------|
| 1 | Front Speaker Positive RH |
| 2 | Rear Speaker Positive RH |
| 3 | Front Speaker Negative RH |
| 4 | Rear Speaker Negative RH |
| 5 | Front Speaker Positive LH |
| 6 | Rear Speaker Positive LH |
| 7 | Front Speaker Negative LH |

Information and Entertainment

| | |
|----|----------------------------|
| 8 | Rear Speaker Negative LH |
| 9 | Hand Brake Signal |
| 10 | Back Light Control Ground |
| 11 | Reverse Signal |
| 12 | Back Light Control |
| 13 | Radio Antenna Power Supply |
| 14 | Ignition Switch (ACC) |
| 15 | Power Ground |
| 16 | Power Source |

AV Connector End View

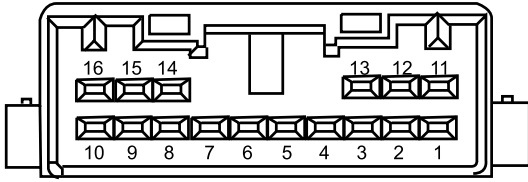


S141010

Connector Pin Detailed Information Chart

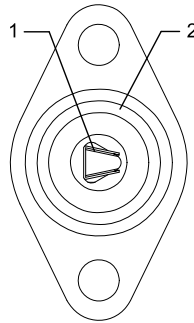
| Pin No. | Description |
|---------|--|
| 1 | Steering Wheel Switch Negative |
| 2 | No Connection |
| 3 | Vehicle Speed Signal |
| 4 | AUX Connected with Negative Tester Probe |
| 5 | Sound Track RH |
| 6 | Audio Ground |
| 7 | Sound Track LH |
| 8 | AUX Video Negative |
| 9 | Rear Camera Negative |
| 10 | Microphone Negative |
| 11 | Steering Wheel Switch Positive |
| 12 | No Connection |
| 13 | AUX Connected with Positive Tester Probe |
| 14 | AUX Video Positive |
| 15 | Rear Camera Positive |
| 16 | Microphone Positive |

AV Connector End View (Communication and Navigation)



| Pin No. | Description |
|---------|--------------|
| 1 | GPS Positive |
| 2 | GPS Negative |

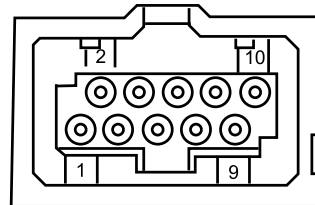
Radio Antenna Connector End View



Connector Pin Detailed Information Chart

| Pin No. | Description |
|---------|--------------|
| 1 | GPS Positive |
| 2 | GPS Negative |

USB Connector End View



S141012

Connector Pin Detailed Information Chart

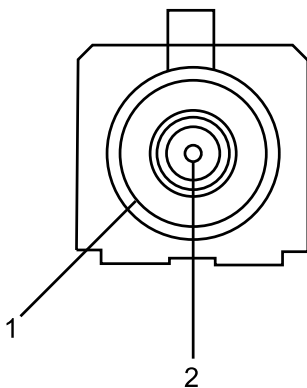
| Pin No. | Description |
|---------|--|
| 1 | No Connection |
| 2 | USB Power Supply |
| 3 | No Connection |
| 4 | USB Connected with Positive Tester Probe |
| 5 | No Connection |
| 6 | USB Connected with Negative Tester Probe |
| 7 | No Connection |
| 8 | USB Ground |
| 9 | No Connection |
| 10 | No Connection |

S141010

Connector Pin Detailed Information Chart

| Pin No. | Description |
|---------|--|
| 1 | Steering Wheel Switch Negative |
| 2 | No Connection |
| 3 | Vehicle Speed Signal |
| 4 | AUX Connected with Negative Tester Probe |
| 5 | Sound Track RH |
| 6 | Audio Ground |
| 7 | Sound Track LH |
| 8 | AUX Video Negative |
| 9 | Rear Camera Negative |
| 10 | Microphone Negative |
| 11 | Steering Wheel Switch 1 Positive |
| 12 | Steering Wheel Switch 2 Positive |
| 13 | AUX Connected with Positive Tester Probe |
| 14 | AUX Video Positive |
| 15 | Rear Camera Positive |
| 16 | Microphone Positive |

GPS Connector End View



S141011

Connector Pin Detailed Information Chart

Operation

The entertainment system can be operated only when the wireless key is inserted or the ignition switch is turned on.

For more information about the entertainment system operation, refer to the Owner's Manual and the Navigation Manual.

Service Procedures**Navigation Antenna****Removal**

1. Remove the navigation display unit.

Navigation Display Unit

2. Unscrew the 2 screws securing the navigation antenna to the instrument panel.

Refit

1. Secure the navigation antenna to the instrument panel, fit the 2 screws and tighten to 1.3-1.9 Nm.
2. Fit the navigation display unit.

Navigation Display Unit**Antenna Amplifier**

- 1.

Removal

- 1.

Refit

- 1.

Front Door Speaker Assembly

Removal

- 1.

Refit

- 1.

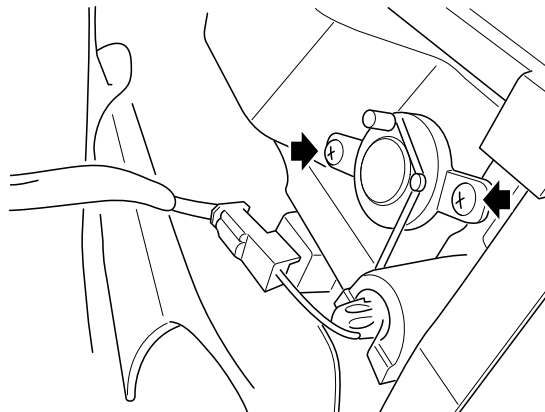
Front Door Tweeter

Removal

1. Remove the front door inner garnish.

Front Door Inner Garnish

2. Loosen the front door tweeter connector.
3. Unscrew the 2 screws securing the tweeter to the front door.



S141020

Refit

1. Secure the tweeter to the front door, fit 2 screws and tighten to 0.8-1.2 Nm.
2. Connect the tweeter connector.
3. Fit the front door inner garnish.

Front Door Inner Garnish

Rear Door Speaker Assembly***Removal***

1.

Refit

1.

Rear Door Tweeter

1.

Removal

1.

Refit

1.

CD Player

Removal

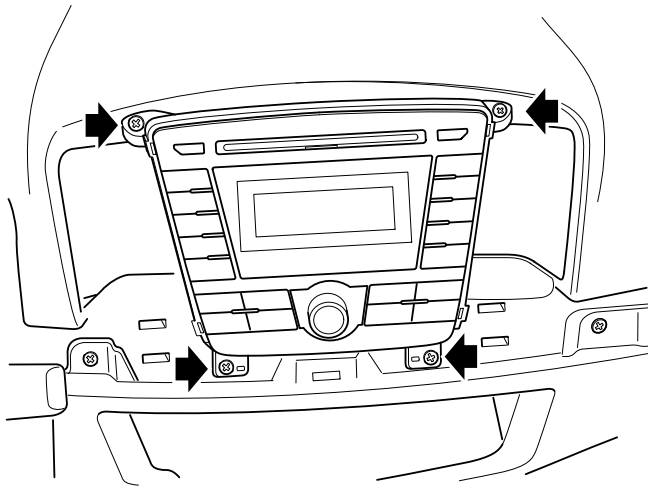
1. Disconnect the battery negative terminal.
2. Remove the air conditioning vent panel.

Air Conditioning Vent Panel

3. Remove the instrument panel garnish.

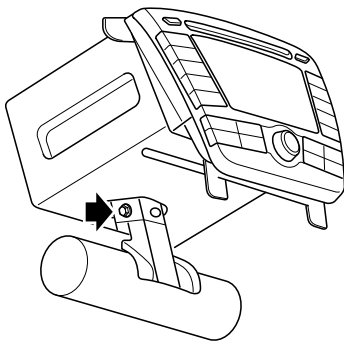
Instrument Panel Garnish

4. Unscrew the 4 screws securing the CD player to the instrument panel.



S141023

5. Unscrew the 2 bolts securing the CD player to the CBB bracket.



S141022

6. Loosen all the connectors on the CD player.

Refit

1. Secure the CD player to the instrument panel, and connect all the connectors.
2. Fit the 2 bolts securing the CD player to the CBB bracket and tighten to 6-8 Nm.
3. Fit the 4 screws securing the CD player to the instrument panel and tighten to 1.3-1.9 Nm.
4. Fit the instrument panel garnish.

Instrument Panel Garnish

5. Fit the air conditioning control panel.

Air Conditioning Vent Panel

6. Connect the battery negative terminal.

Navigation Display Unit**Removal**

1. Disconnect the battery negative terminal.
2. Remove the air conditioning vent panel.

Air Conditioning Vent Panel

3. Remove the instrument panel garnish.

Instrument Panel Garnish

4. Unscrew the 4 screws securing the navigation display unit to the instrument panel.
5. Unscrew the 2 bolts securing the navigation display unit to the CBB bracket.
6. Loosen all the connectors on the navigation display unit.

Refit

1. Secure the navigation display unit to the instrument panel, and connect all the connectors.
2. Fit the 2 bolts securing the navigation display unit to the CBB bracket and tighten to 6-8 Nm.
3. Fit the 4 screws securing the navigation display unit to the instrument panel and tighten to 1.3-1.9 Nm.
4. Fit the instrument panel garnish.

Instrument Panel Garnish

5. Fit the air conditioning control panel.

Air Conditioning Vent Panel

6. Connect the battery negative terminal.

Displays and Gages

Specifications

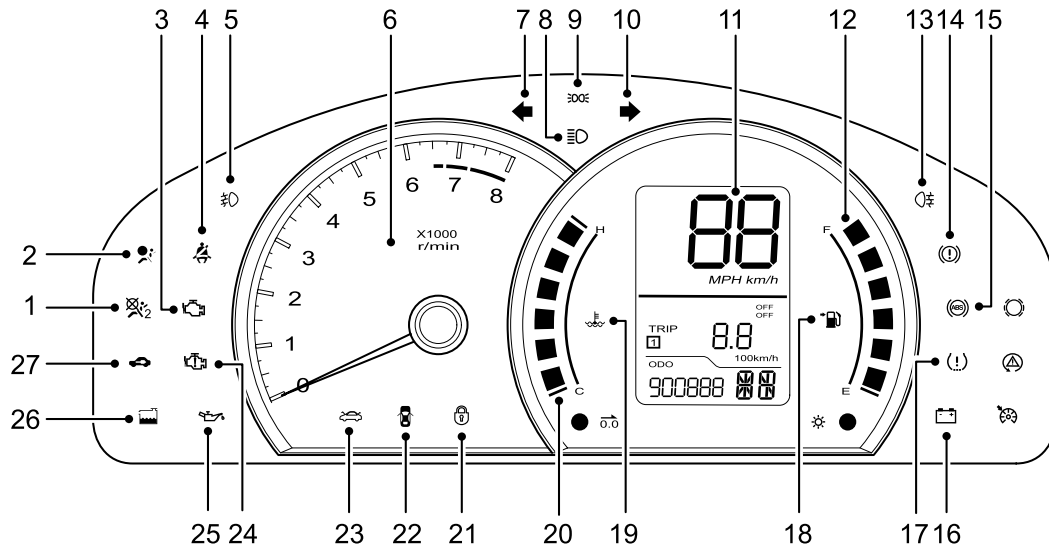
Torque

| Description | Value |
|---|------------|
| Screw - Instrument Pack to Upper Instrument Panel | 1.3-1.9 Nm |

Description and Operation

System Component Layout

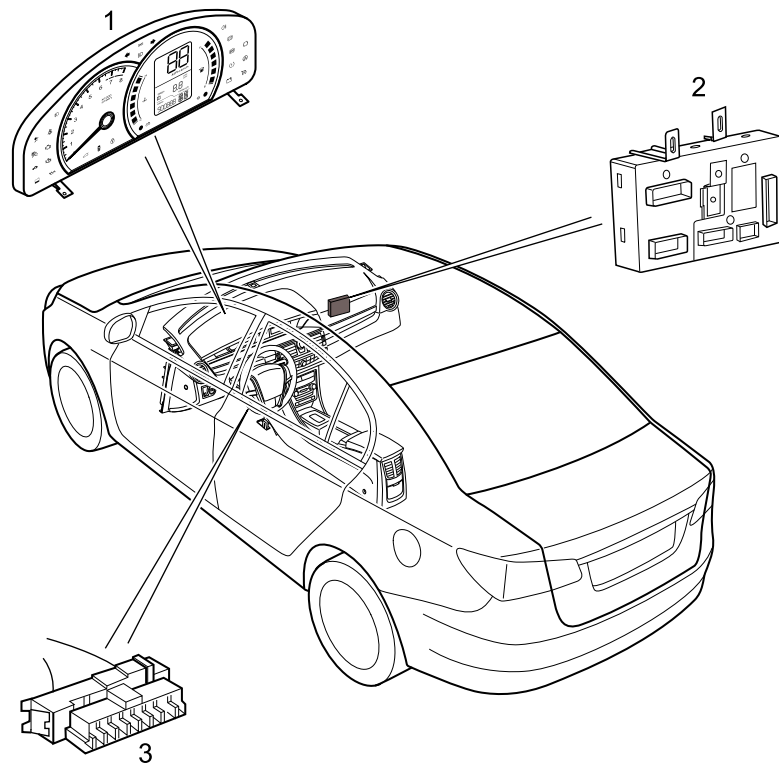
Instrument Pack Component Layout



S742018

- | | |
|---|---|
| <ul style="list-style-type: none"> 1. Front Passenger Airbag OFF Warning Light 2. Airbag Warning Light 3. Engine Emission Malfunction Warning Light 4. Seat Belt Unfastened Warning Light 5. Front Fog Indicator 6. Tachometer 7. Left Direction Indicator 8. Main Beam Indicator 9. Side Light Indicator 10. Right Direction Indicator 11. Information Centre 12. Fuel Gauge 13. Rear Fog Indicator 14. Brake System Malfunction Warning Light | <ul style="list-style-type: none"> 15. ABS Warning Light 16. Alternator Charge Warning Light 17. Tyre Pressure Monitoring System (TPMS) Warning Light 18. Low Fuel Level Warning Light 19. Engine Coolant High Temperature Warning Light 20. Engine Coolant Temperature Receiver Gauge 21. Immobilizer System Lock Status Warning Light 22. Door Open Warning Light 23. Bonnet/Boot Open Warning Light 24. Engine Malfunction Warning Light 25. Low Oil Pressure Warning Light 26. Low Coolant Level 27. Engine Immobilizer System Warning Light/Low Key Battery Blink Warning Light |
|---|---|

Meter Unit Component Layout

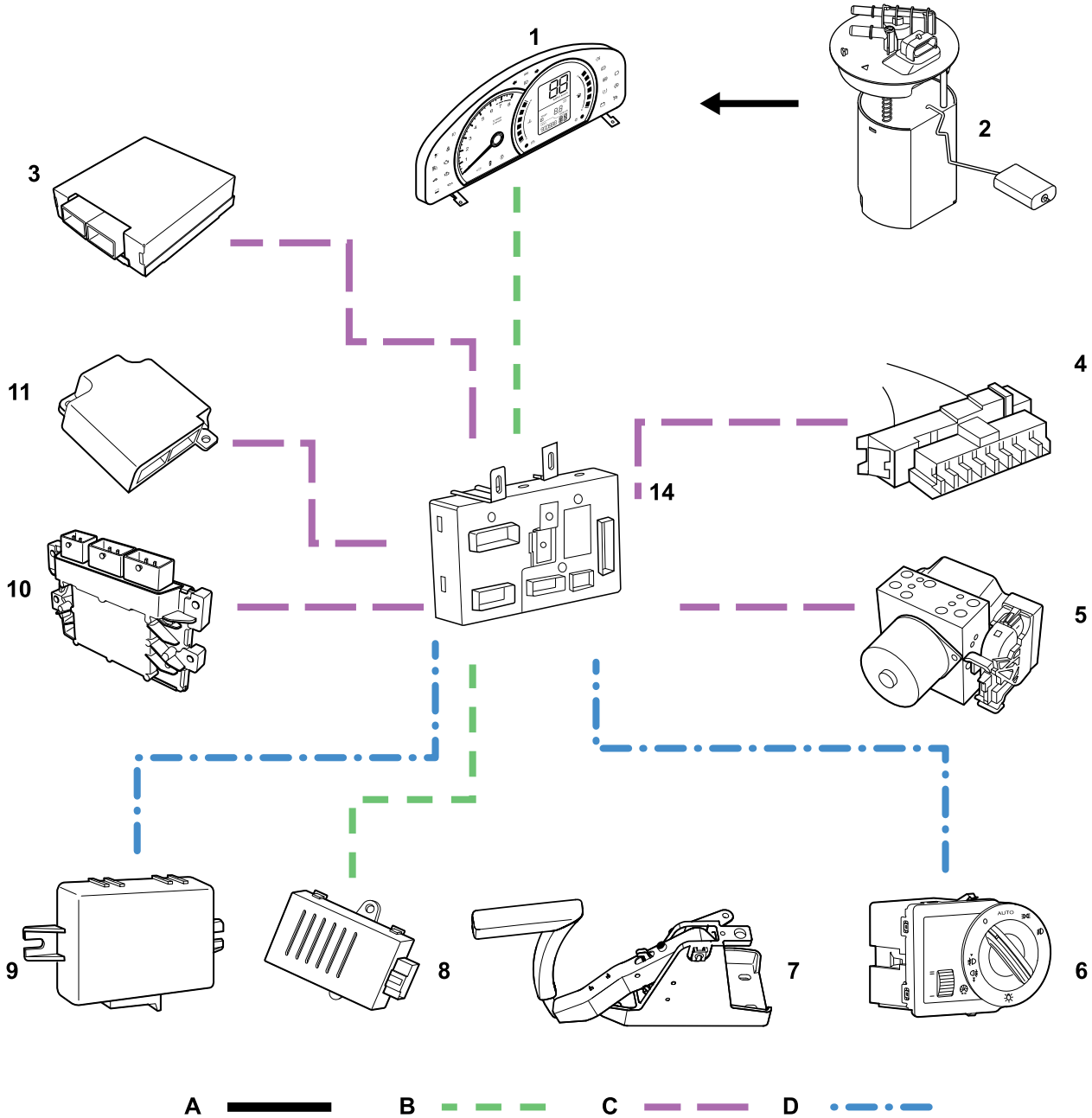


1. Instrument Pack

2. Body Control Module (BCM)

3. Diagnostic Socket

System Control Diagram



A = Hard Wire; B = Medium Speed CAN Bus Line; C = High Speed CAN Bus Line; D = LIN Bus Line

- | | |
|------------------------------------|---|
| 1. Instrument Pack | 7. Parking Brake Handle |
| 2. Fuel Level Sensor | 8. Electronic Steering Column Lock Controller |
| 3. Transmission Control Unit (TCU) | 9. Parking Distance Control Unit |
| 4. Diagnostic Socket | 10. Engine Control Module |
| 5. ABS/DSC Control | 11. Airbag Control Module |
| 6. Master Light Switch | 12. Body Control Module (BCM) |

Description

General Description

The instrument pack is secured to the instrument panel with 2 screws and connected to the body wire harness with a connector. An entertainment display, with advanced or low configuration, is fitted on the right side of the instrument pack depending on the model. For details, refer to the entertainment system section.

The instrument pack is an enclosed (integrated) component, which cannot be removed or repaired. The reset operation of the trip computer (on-board computer) function or some individual settings can be performed with the information centre control switch. For details, refer to the information centre control switch section.

Caution: The dealer must carry out reset setting to the maintenance intervals with the diagnostic tool each time after the routine maintenance. After replacing or inflating the tyre, the reset of the tyre pressure monitoring system should be carried out with the menu of the information centre display.

Displayed Information

The combination meter provides the information related to the status of the vehicle parameters, such as the speed, engine coolant temperature, fuel level and so on, which are displayed to the driver in the form of LCD, warning light, analog type dial, segment digital type water temperature gauge and fuel gauge.

The displayed information mainly consists of the followings:

- Tachometer.
- Speedometer - **LCD**.
- Engine Coolant Temperature Receiver Gauge - **LED**, with Warning Light. When the water temperature is too high, the warning will be activated.
- Fuel Gauge - **LED**, with Warning Light. When the fuel level is too low, the warning will be activated.
- Direction Indicator and Warning Light.
- Information Centre. It displays the warning information, total distance, gear position information, trip distance (Trip 1, Trip 2) (the fuel range to empty, average fuel consumption, average speed) and the vehicle over speed function off (ON/OFF).

When the wireless key is turned to IGN, all the warning lights will be illuminated simultaneously for 3 seconds to perform the self-check.

Bus Line Communication

The instrument pack mainly receives the information through the high speed**CAN** bus line. The nodes on the high speed**CAN** are the meter, **ABS**, engine control module, airbag, shift control unit and body control unit. The instrument

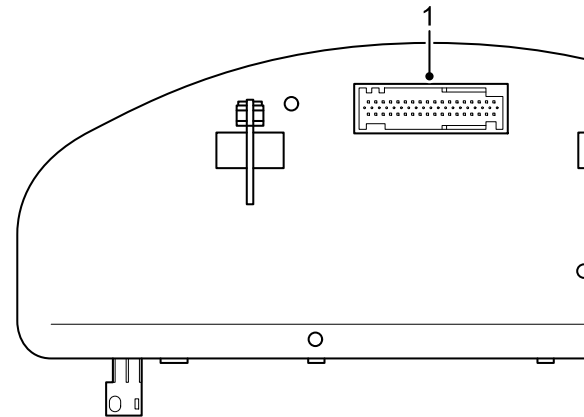
pack receives and sends the signal through the high speed**CAN** bus line. The bus line signals received and sent by the meter are shown in the table below.

| Signal Name | Transmitting Component | Receiving Component |
|--|------------------------|---------------------|
| ABS Warning Light | ABS/DSC Control Module | Instrument Pack |
| Airbag Malfunction | SRS ECU | Instrument Pack |
| Passenger Side Airbag Disabled Warning Light | BCM | Instrument Pack |
| Alternator Charge Warning Status | Hard Wire | Instrument Pack |
| Brake Fluid Level | Hard Wire | Instrument Pack |
| Door and Trunklid Open | BCM and Hard Wire | Instrument Pack |
| Engine Coolant Temperature | ECM | Instrument Pack |
| Engine Malfunction Indicator Light (MIL) | ECM | Instrument Pack |
| Low Oil Pressure | Hard Wire | Instrument Pack |
| Engine Speed | ECM | Instrument Pack |
| Fuel Gauge | Hard Wire | Instrument Pack |
| Transmission Case Gear Position Information | TCU | Instrument Pack |
| Transmission Case Malfunction | TCU | Instrument Pack |
| Hand Brake On | Hard Wire | Instrument Pack |
| Back Light Brightness Control Signal | IPK | Instrument Pack |
| Parking Distance Control | PDC-ECU | Instrument Pack |
| Seat Belt Status | Hard Wire | Instrument Pack |
| Seat Belt Unfastened Warning | Hard Wire | Instrument Pack |
| Engine Immobilizer System Warning Status | BCM | Instrument Pack |
| Engine Immobilizer System Warning Activation | BCM | Instrument Pack |
| Wireless Key Battery Low | BCM | Instrument Pack |
| Vehicle Speed | ABS/DSC Control Module | Instrument Pack |
| Vehicle State Lock | BCM | Instrument Pack |

| | | |
|--|------------------------|-----------------|
| Vehicle Identification Code (VIN Code) | BCM | Instrument Pack |
| Wheel Speed Pulse Signal | ABS/DSC Control Module | Instrument Pack |
| Tyre Pressure Monitor | ABS/DSC Control Module | Instrument Pack |

Wire Connector

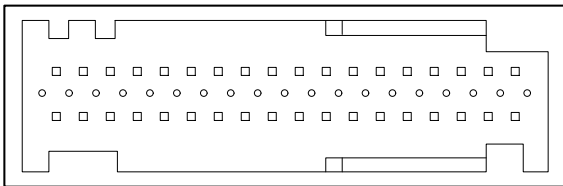
Instrument Pack Wire Connector Position Schematic Diagram



S742021

I. Meter Wire Connector

Instrument Pack Wire Connector End View



S742022

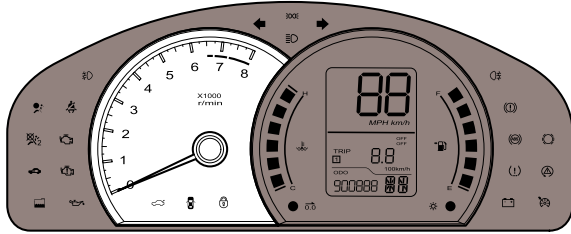
Instrument Pack Wire Connector Pin Detailed Information Chart

| Pin No. | Description |
|---------|---|
| 1 | KL.30 |
| 2 | Earth Lead KL.31 |
| 3 | Immobilizer System and Lock Warning Light |
| 4 | Unused |
| 5 | KL.15 |
| 6 | Alternator Charge |
| 7 | Hand Brake |
| 8 | Unused |
| 9 | Engine Oil Pressure |
| 10 | Brake Fluid Level |

| | |
|----|--|
| 11 | Coolant Level |
| 12 | PDC Warning PDC |
| 13 | Side Light (Side Marker Light) |
| 14 | Main Beam |
| 15 | Left Direction Indicator |
| 16 | Right Direction Indicator |
| 17 | Driver Side Door Open |
| 18 | Front Fog Lamp |
| 19 | TPMS Reset Input |
| 20 | Seat Belt Buckle Switch |
| 21 | Unused |
| 22 | Fuel Sender Signal Wire+ |
| 23 | Fuel Sender Earth Lead- |
| 24 | Unused |
| 25 | Unused |
| 26 | Medium Speed CAN Bus Line, High Speed CAN Bus Line H |
| 27 | Medium Speed CAN Bus Line, Low Speed CAN Bus Line L |
| 28 | Key-in-Reminder Function |
| 29 | Unused |
| 30 | Unused |
| 31 | Unused |
| 32 | Unused |

Main Display Functions for Instrument Pack

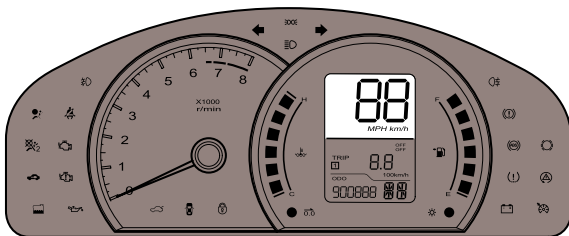
Tachometer



S742023

The tachometer indicates the engine speed with the number of turns (X1000) per minute. The red area at the high speed end of the tachometer scale range is used to warn the driver that if the engine speed is too high, the engine may be damaged. When the ignition switch is turned to "IGN", the instrument pack receives the engine speed signal through the high speedCAN bus line from the ECM.

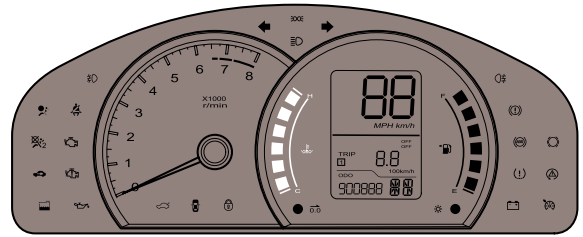
Speedometer



S742024

The speedometer uses a segment digital typeLCD to display. ABS/DSC calculates the vehicle speed by collecting the wheel speed pulse signal. The instrument pack receives the vehicle speed signal through the high speedCAN bus line from the ABS/DSC module, and displays the vehicle speed signal after it has been corrected and calculated.

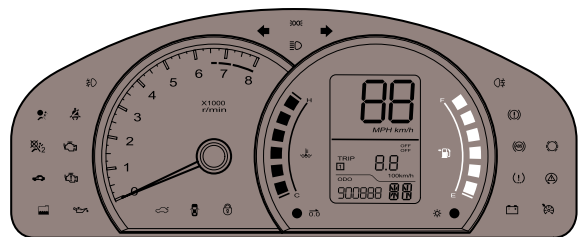
Engine Coolant Temperature Receiver Gauge



S742025

The engine coolant temperature receiver gauge is located on the left side of the tachometer, and it uses a segment digital typeLED to display. When the vehicle operates normally, the water temperature receiver gauge may illuminate the range of the 1-4 segments. The 5th and 6th segments are the two levels of the white warning zone, which are used to indicate that the engine coolant temperature is too high, and that the engine will be damaged if it continues to run, so the vehicle must stop running immediately. When the 5th and 6th segments come on, the water temperature warning light comes on with one warning sound. When the 5th and 6th segments blink, the water temperature warning light also blinks with a continuous warning sound. The meter receives the water temperature signal through the high speedCAN from the EMS.

Fuel Gauge



S742026

The fuel gauge is located on the right side of the information centre, it uses the 6 white bar typeLED to display in the form of segment digital, and is directly connected to the fuel level sensor with the hard wire. When the ignition key is turned to IGN, the fuel gauge starts to operate. When the segments of the fuel gauge change to one segment from two segments, the first segment blinks, and the low fuel level warning light comes on with one warning sound at this time. When the fuel level

continues to drop, the first segment goes out and the low fuel level warning light blinks with six warning sounds at this time.

Caution: *While the vehicle is running, if the meter detects that the fuel level sensor signal exceeds the available range (maybe because of the open circuit of the sensor caused by the impurity in the fuel), the meter will use the effective fuel amount recorded previously and the injector signal received from ECM to calculate the remaining fuel amount until the current ignition cycle finishes. If fuel level sensor signal exceeding the available range is still detected when the next ignition is switched on, the first LED segment of the fuel gauge and low fuel level warning light flash simultaneously, and the information centre will display "Fuel Level Signal Fault". However, this will not affect the normal operating of the vehicle, and the meter will return to normal display after the fuel level signal returns to normal.*

Warning Display

Direction Indicator (Left, Right)

The left and right direction indicators are indicated by the green arrows located at the bottom of the instrument pack. Whenever the direction indicators operate, the left or right direction indicator will blink. If the hazard warning light operates, the left and right direction indicators will blink simultaneously.

ABS Warning Light

This warning light is yellow. After finishing the self-check, if the **ABS** warning light comes on with the warning sound, it indicates that there is a malfunction in the **ABS** system, and the emergency measures should be taken. Even if the malfunction appears in the **ABS** system, the brake function can be performed normally.

Parking Brake and Brake System Warning Light

This red warning light is used to inform the driver: 1. The **ABS** detects malfunction in the electronic brake distribution (**EBD**); 2. The brake fluid level is low; 3. The hand brake is engaged. After the engine starts, if there is **EBD** malfunction or the brake fluid level is low, or if the vehicle speed exceeds 5 km/h with the hand brake engaged, the lights will blink with the repeated warning sounds.

Engine Malfunction Warning Light

This warning light is yellow. This indicator is used to indicate the malfunction greatly affecting the engine performance (except the emission malfunction), which is detected by the engine management system. When the ignition switch is turned to **IGN**, the self-check starts, and the warning light goes out after finishing the self-check. After the engine starts, if the warning light illuminates with a warning sound, it indicates

that the **EMS** has a malfunction which has greatly affected the engine performance, causing the engine limp home, for example, malfunctions of the electronic throttle, accelerator pedal, **ECU** reference voltage and so on.

Engine Emission Malfunction Warning Light

This warning light is yellow. This warning light is used to indicate the malfunction affecting the engine performance and the emission, which is detected by the engine management system. When the ignition switch is turned to **IGN**, the self-check starts, and the warning light remains on after finishing the self-check. After the engine starts, this light turns off if there is no problem; after the engine starts, if the warning light comes on with the warning sound, it indicates that the malfunction affecting the engine performance and the emission occurs in the **EMS**.

Tyre Pressure Monitoring System (TPMS) Warning Light

This warning light has two colors: red and yellow. After finishing the self-check with key-on, if this warning light illuminates in yellow, it indicates that a problem occurs in the tyre pressure monitoring system; if it illuminates in red, it indicates the tyre pressure is insufficient.

Caution: *When the pressure of the 4 tyres is confirmed to be inflated to the normal range, be sure to reset the TPMS through the "Tyre Pressure Resetting" menu of the information display centre (for details, please refer to the section of "Information Centre Display Operation"). If the gauge receives the correct feedback from DSC in 2 seconds, information centre display will display the information of "tyre Pressure Resetting Successful"; or it will display "tyre Pressure Resetting Failed".*

Alternator Charge Warning Light

This warning light is red. The signal is sent to the meter through the hard wire. When the ignition key is turned to **IGN**, if no electricity is generated, this warning light will come on. Important: If the engine does not start and the ignition key is turned to **IGN**, it is normal that the warning light comes on. After the engine starts, if the generator does not generate electricity normally, this warning light will come on with the warning sound.

Seat Belt Unfastened Warning Light

This warning light is red. After finishing the self-check, if this warning light comes on, it indicates that the driver or front passenger seat belt is unfastened. After the engine starts, the warning light comes on with one warning sound. If the seat belt is still unfastened, the seat belt unfastened warning light will blink with repeated warning sounds until it is fastened or 90 seconds has elapsed.

Airbag Warning Light

This warning light is red. If this warning light comes on after finishing the self-check, this means the malfunction is detected in the airbag control unit, and the warning light comes on with one warning sound after the engine starts. Because this is an important safety system warning function, this warning light is continuously detected by the meter when the key is turned to IGN, if there is a malfunction in this warning light, it will come on with the warning sound.

Main Beam Indicator

This warning light is blue. The signal is sent to the meter through the hard wire. When the main beam lamp comes on, this indicator is illuminated. It informs the driver that the main beam lamp has been illuminated.

Front Fog Indicator

The front fog indicator is green. When the ignition key is turned to IGN and the front fog lamp is turned on, this signal indicator will be illuminated.

Rear Fog Indicator

The rear fog indicator is yellow. When the ignition key is turned to IGN and the rear fog lamp is turned on, this signal indicator will be illuminated.

Side Marker Light Indicator, Side Light Indicator

The side marker light indicator is green. When the ignition key is turned to IGN and the side light is turned on, this signal indicator will be illuminated.

Low Oil Pressure Warning Light

The red warning light is illuminated when a low engine oil pressure malfunction is detected. After the engine starts, a warning will sound to inform the driver. Pay attention to the malfunction, and handle it immediately if possible. Otherwise, the engine will be damaged.

Passenger Side Airbag Warning Light

This warning light is yellow. If the warning light comes on after finishing the self-check, this means the passenger side airbag is closed. Because this is an important safety system warning function, this warning light is continuously detected by the meter when the key is turned to IGN, and if there is a malfunction in this warning light, it will come on with the warning sound.

Engine Immobilizer System Warning Light

This warning light is yellow. When the key is turned to IGN, the starter cannot be started if the immobilizer system verification fails, and the warning light comes on at this time. If the key battery is low, the warning light will blink with one warning sound. If the immobilizer system verification fails and the key battery is low, these will cause the warning light to blink.

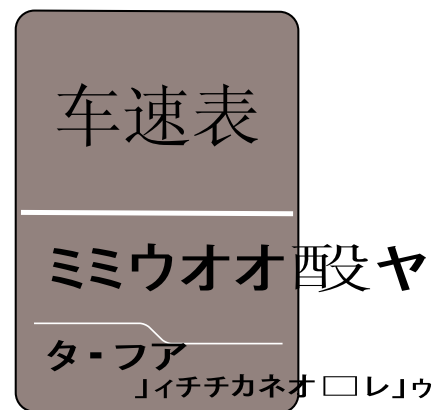
Door Open Warning Light

This warning light is red. This warning light is illuminated when the ignition switch is turned on, then the system inspection begins, and the light goes out when the engine starts. If there is a door unclosed, the warning light will not go out with the continuous warning sound.

Bonnet/Boot Open Warning Light

This warning light is yellow. It is used to indicate that the bonnet/boot open warning light is on. This light will be on for 3 seconds when the ignition switch is turned on, then the system inspection begins, and it will be off after the engine starts. This light will blink if the bonnet is open, and there will be a warning sound if it is open while driving; this warning light will illuminate if the boot is open, and blink if both of the bonnet and trunklid are open.

Information Centre



S742014

On-Board Computer

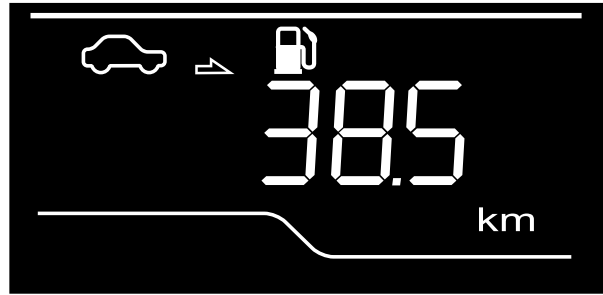
The on-board computer displays the following information on the LCD: Trip 1, Trip 2, Fuel Range to Empty, Average Fuel Consumption and Average Vehicle Speed. Press and hold the change/reset button on the left side of the meter for less than 1 second, the display will change according to the following information.



S742027

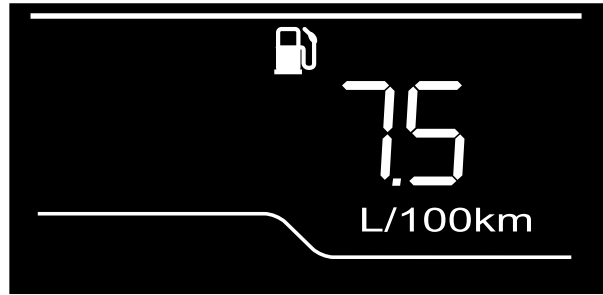
Trip 1 and Trip 2

The trip distance is displayed in km. The range displayed is 0-9999 km. If the distance is less than 1000 km, it changes in the unit of 0.1 km; if the distance is more than 1000 km, it changes in the unit of 1 km. When the distance reaches 9999 km, it will be reset automatically.



S742030

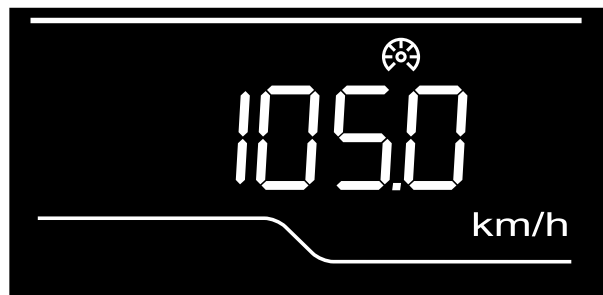
Average Fuel Consumption



S742031

Average Speed

It is the average vehicle speed calculated in km/h after the engine starts.



S742032

Change/Reset Button

The subtotal distance (Trip 1 and Trip 2) resets after removing the battery or pressing and holding the change/reset button for more than 2 seconds.

The average fuel consumption resets after removing the battery or pressing and holding the change/reset button for more than 2 seconds. Three horizontal lines "--" are displayed



S742028



S742029

Fuel Range to Empty

It indicates driving range that the vehicle can drive with the remaining fuel in the tank, and it is calculated according to the fuel consumption during driving, and changes in the unit of 1 km.

If the fuel consumption decreases and increases evidently because of the change of the driving pattern or road condition, the decrease or increase of the fuel range to empty can be seen.

If three horizontal lines "--" are displayed continuously when driving, contact the dealer.

after resetting, and the value is displayed after driving 300 meters.

The average vehicle speed resets after removing the battery or pressing and holding the change/reset button for more than 2 seconds. Three horizontal lines "-.-" are displayed after resetting, and the value is calculated after the vehicle speed is above 3 km/h.

Instrument Pack Brightness Adjustment

The instrument pack brightness includes the daytime brightness and night brightness. It is night brightness when the side light (small light) is on; otherwise, it is daytime brightness.

The daytime brightness and night brightness are divided into four levels respectively, the button on the right side of the meter is the brightness adjustment button, and the brightness will increase by one level with every press, in circular adjustment. When adjusting the brightness, the total distance display area changes to the brightness level display, and if the button is not pressed within 2 seconds, it changes to the total distance display automatically. The left illustration below shows that the brightness is in the first level, while the right illustration shows that the brightness is in the fourth level.



S742033



S742034

Operation

Operation Mode

The position of the ignition switch determines which function of the instrument pack can be obtained in any specific time.

Ignition Switch "OFF"

When the ignition switch is turned off, if the vehicle battery remains connected, the instrument pack will stay in the "standby mode".

Ignition Switch "ON"

When the ignition switch is turned on, the instrument pack starts the inspection before driving, and the **CAN** bus line

enters the activation status, the following **LCD** lights always come on after performing the self-check for 3 seconds:

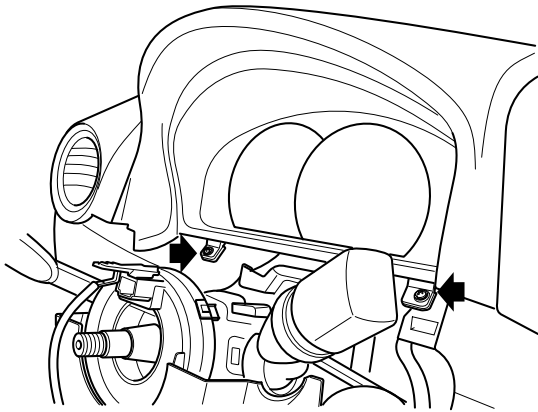
- Low Oil Pressure Warning Light
- Engine Malfunction Warning Light
- Engine Emission Malfunction Warning Light
- Battery Charge Warning Light

Ignition Switch "Start"

If any warning light remains on after the engine starts and all the lights turns off, there is a malfunction in the corresponding system.

Service Procedures**Instrument Pack****Removal**

1. Disconnect the battery negative terminal.
2. Loosen the instrument panel garnish assembly, and pry out the driver side centre and left garnishes.
3. Pull out the meter trim frame assembly, and remove it together with the steering column upper protector.
4. Unscrew the 2 self-tapping screws securing the instrument pack to the upper instrument panel.



S810001

5. Disconnect the electrical connector.
6. Remove the instrument pack.

Refit

1. Connect the electrical connector.
2. Secure the instrument pack to the upper instrument panel, fit the screws and tighten to **1.3-1.9 Nm**.
3. Fit the meter trim frame assembly and the steering column upper protector.
4. Connect the battery negative terminal.

Glossary List

| Name | Description |
|-------------------|---|
| A | Ampere |
| A/C | Air Conditioning |
| ABS | Anti-lock Brake System |
| ATC | Automatic Temperature Control |
| ATF | Automatic Transmission Fluid |
| AUTO | Automatic |
| AUX | Auxiliary |
| BCM | Body Control Module |
| CAN | Controller Area Network |
| CHMSL | Centre High Mounted Stop Lamp |
| CKP | Crankshaft Position |
| CMP | Camshaft Position |
| CO | Carbon Monoxide |
| CO ₂ | Carbon Dioxide |
| DDSP | Driver's Door Switch Pack |
| DSC | Dynamic Stability Control |
| DTC | Diagnostic Trouble Code |
| DVD | Digital Versatile Disc |
| EBD | Electronic Braking-force Distribution |
| ECM | Engine Control Module |
| ECT | Engine Coolant Temperature |
| ECU | Electronic Control Unit |
| EEPROM | Electrically Erasable Programmable Read Only Memory |
| ELR | Emergency Locking Retractor |
| EMS | Engine Management System |
| ETC | Electronic Temperature Control |
| GPS | Global Positioning System |
| HC | Hydro Carbons |
| HO ₂ S | Heated Oxygen Sensor |
| HRW | Heated Rear Window |
| ICE | In Car Entertainment |

| Name | Description |
|-----------------|---|
| ICS | Inflatable Curtain Structure |
| K | Pink |
| LCD | Liquid Crystal Display |
| LED | Light Emitting Diode |
| LIN | Local Interconnect Network |
| MIL | Malfunction Indicator Light |
| MLS | Master Light Switch |
| NO _x | Oxides of Nitrogen |
| NTC | Negative Temperature Coefficient |
| OAT | Organic Acid Technology |
| PAS | Power Assisted Steering |
| PDC | Parking Distance Control |
| PWM | Pulse Width Modulation |
| RON | Research Octane Number |
| SRS | Supplementary Restraint System |
| TCM | Transmission Control Module |
| TMAP | Temperature, Manifold Absolute Pressure |
| TP | Throttle Position |
| TWC | Three-way Catalyst |
| TXV | Thermostatic Expansion Valve |
| V | Volt (voltage) |
| VIN | Vehicle Identification Number |